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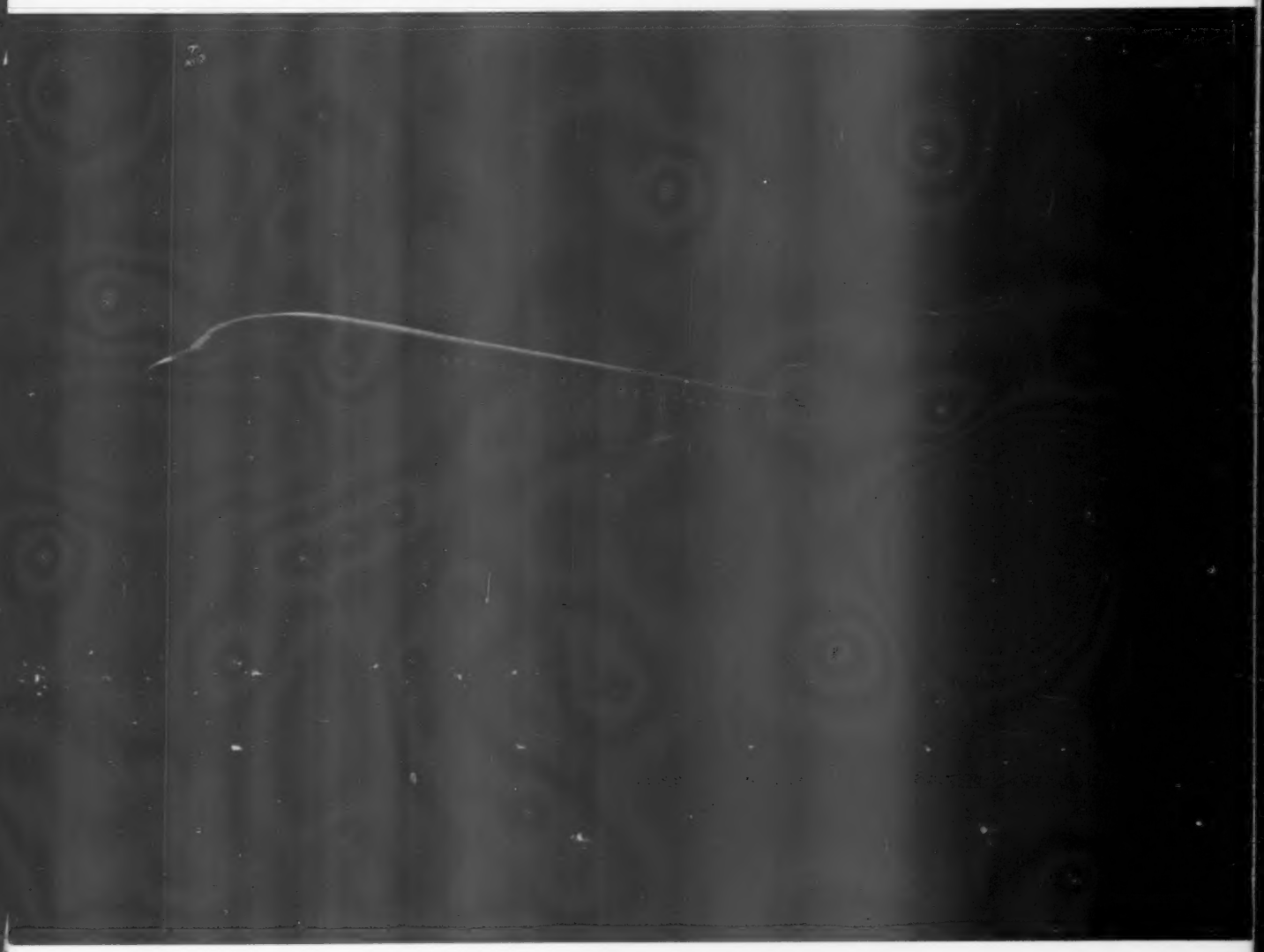

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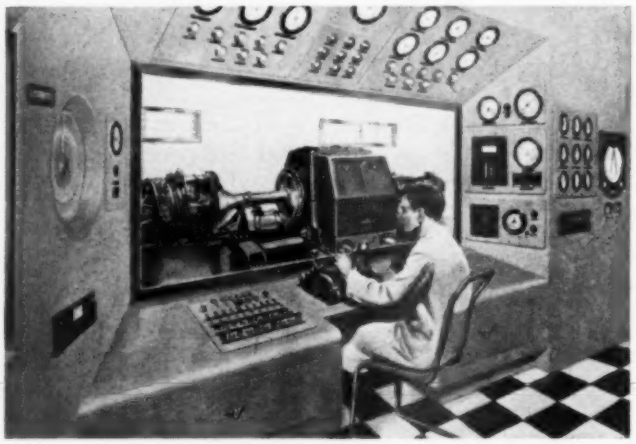

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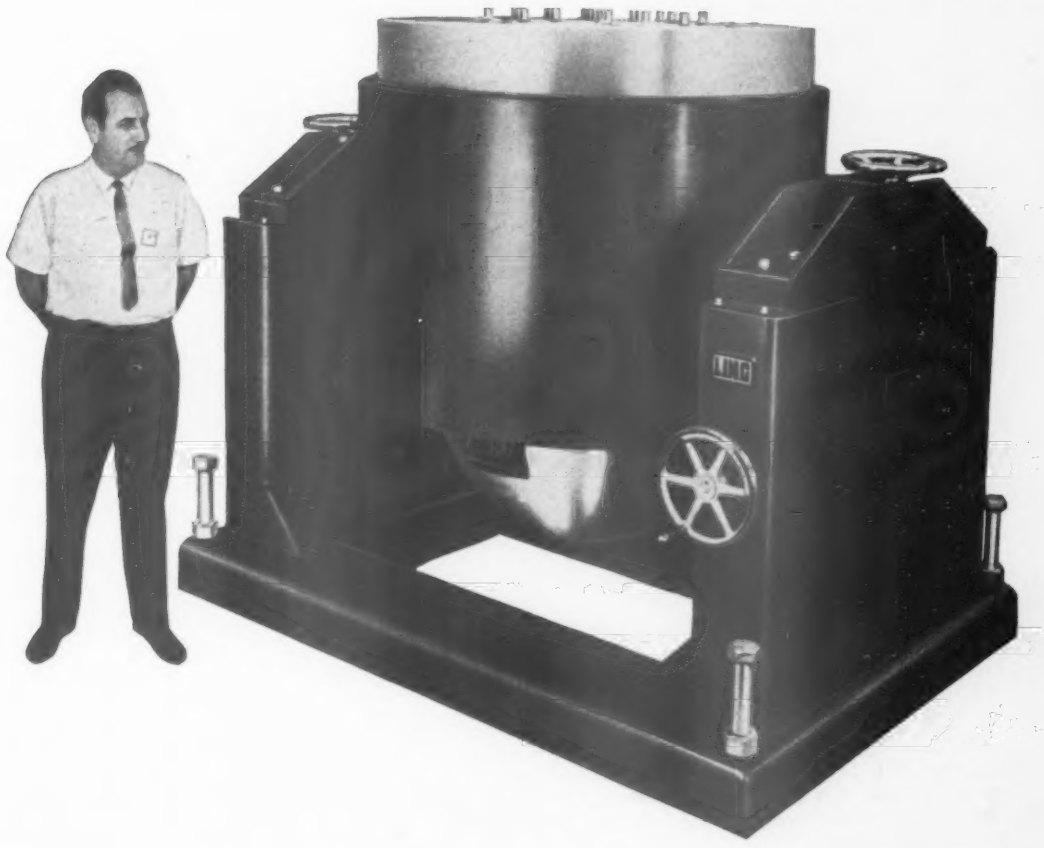

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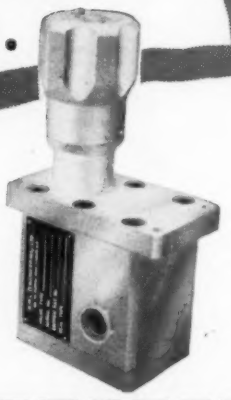

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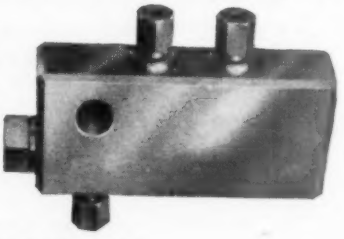

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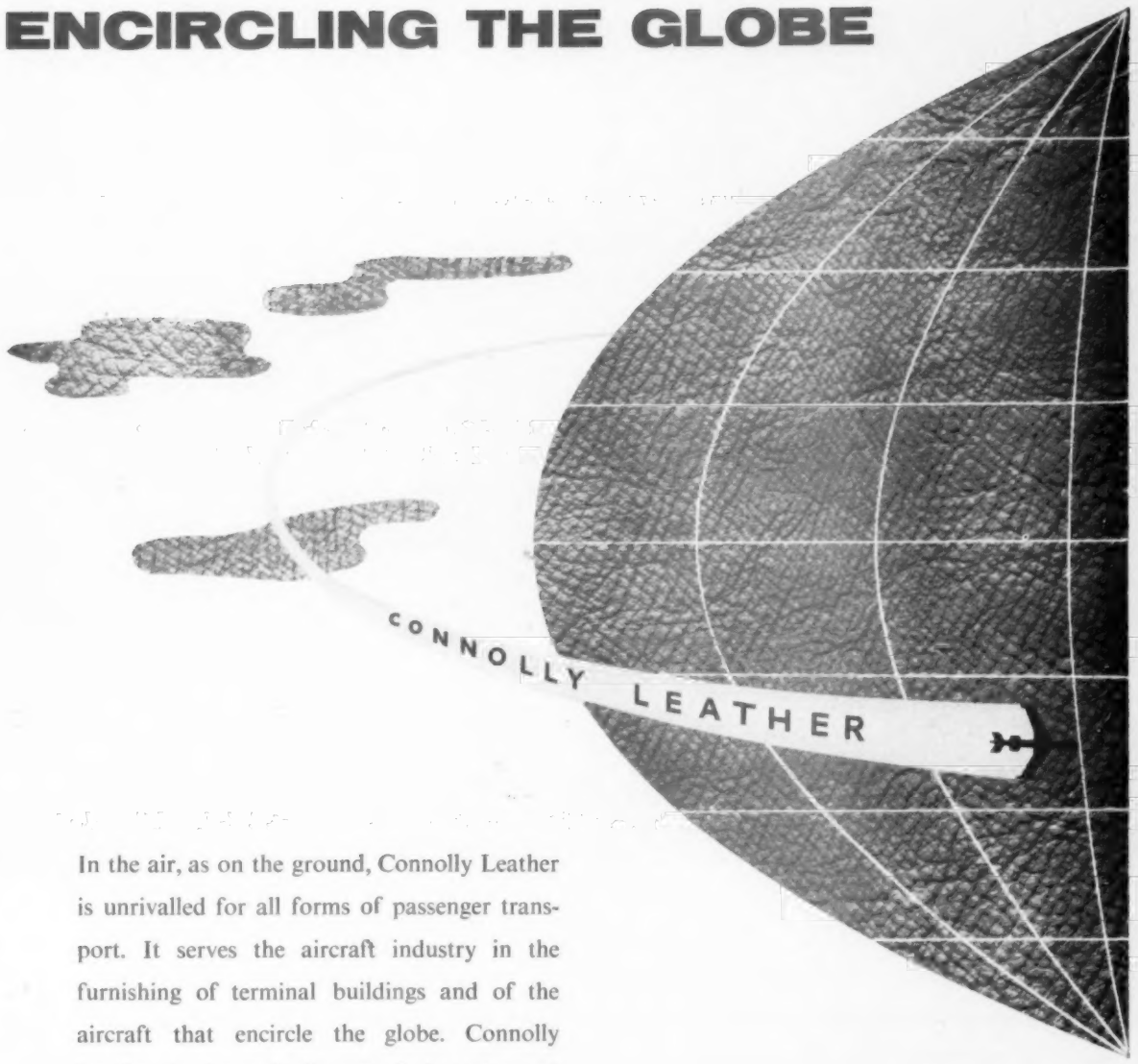

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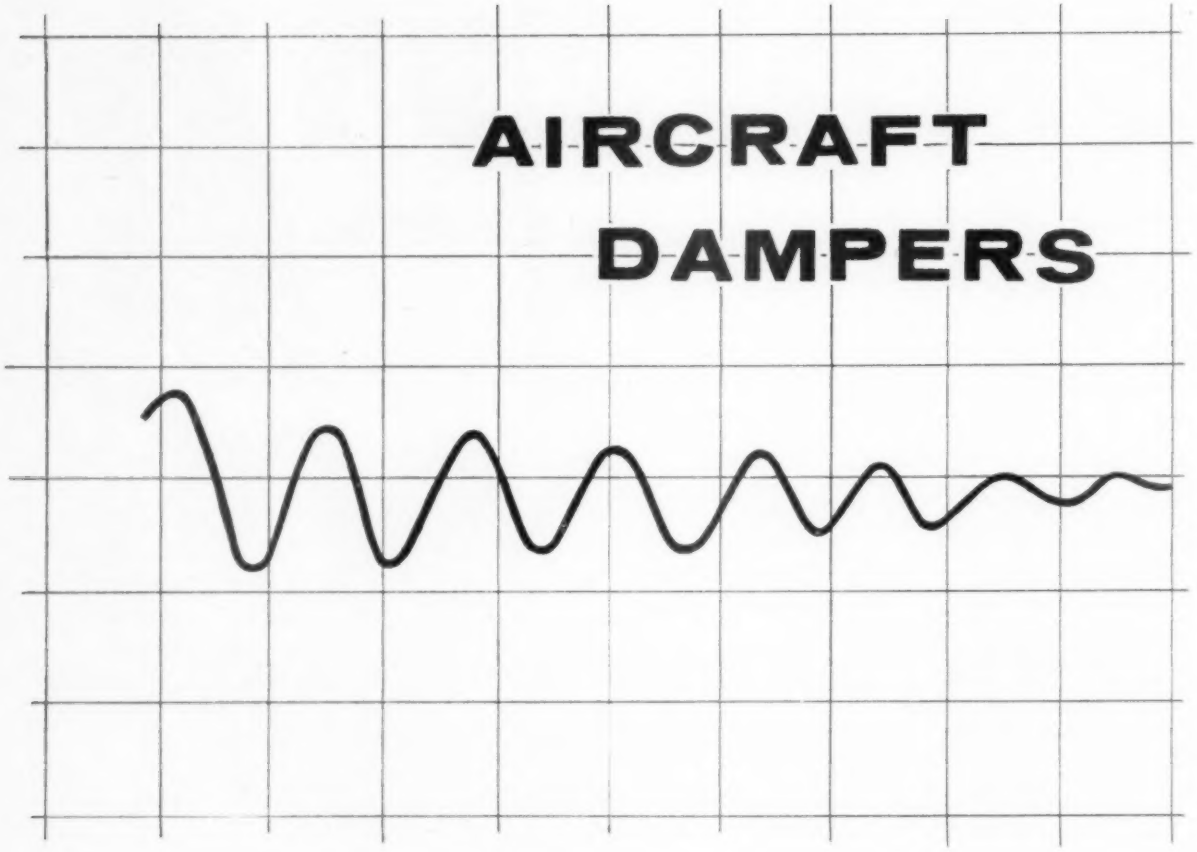

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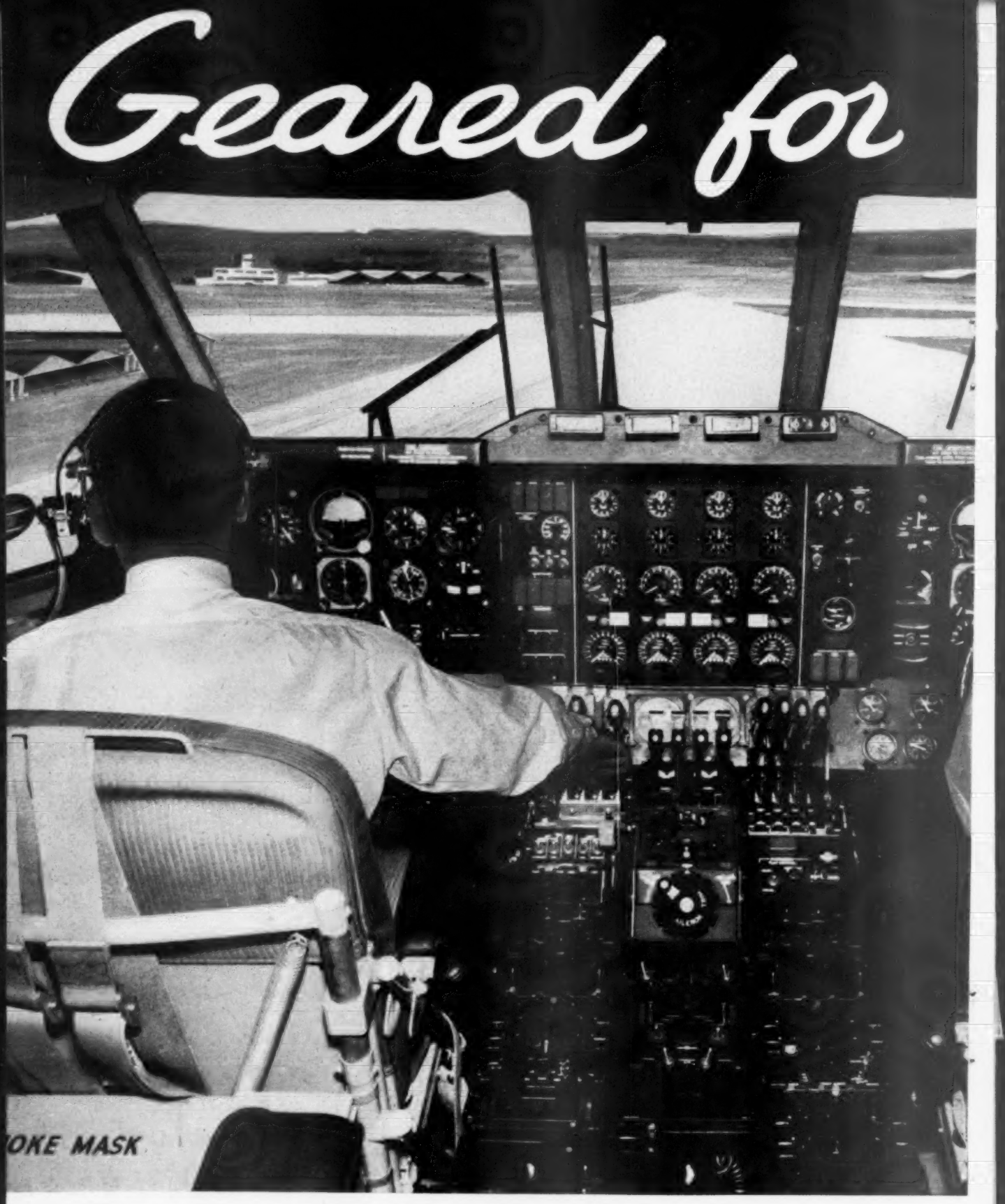

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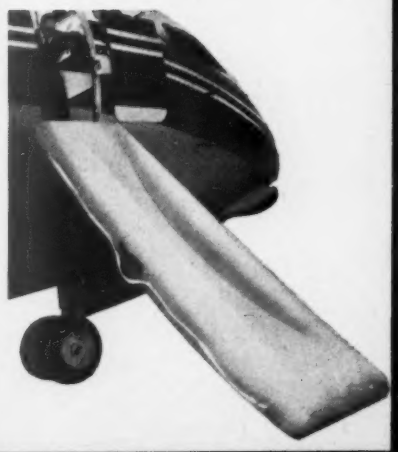

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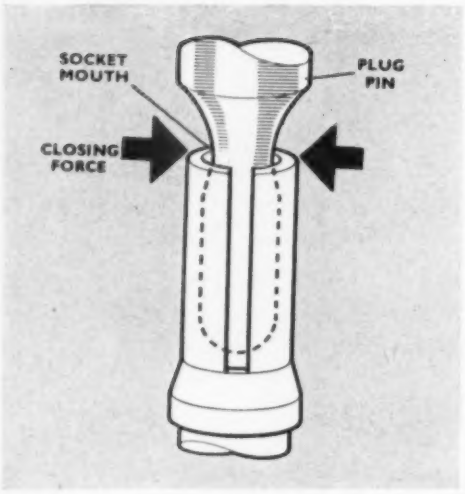

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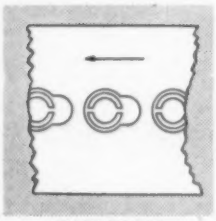

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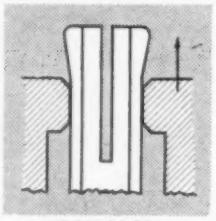

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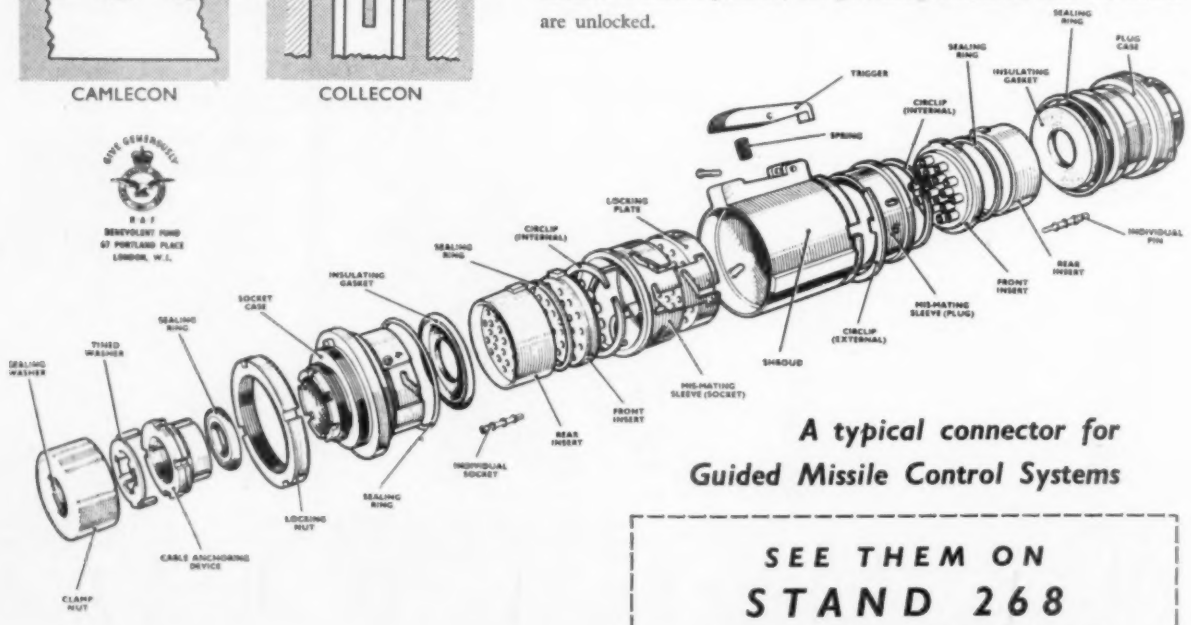

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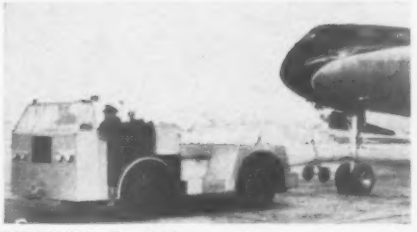

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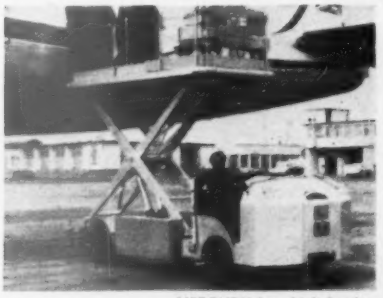

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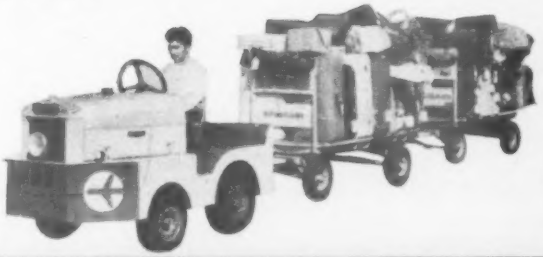

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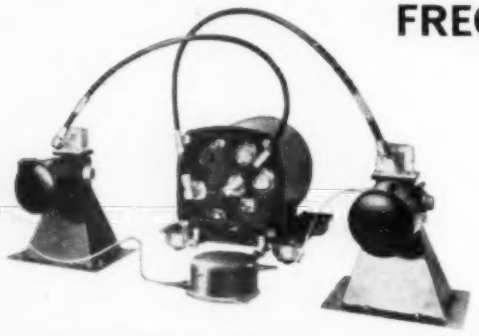

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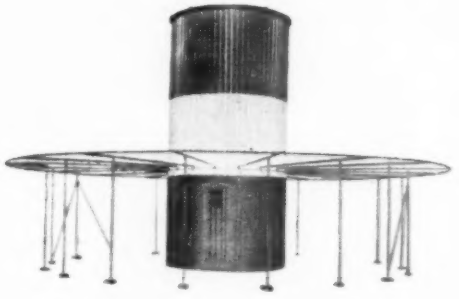

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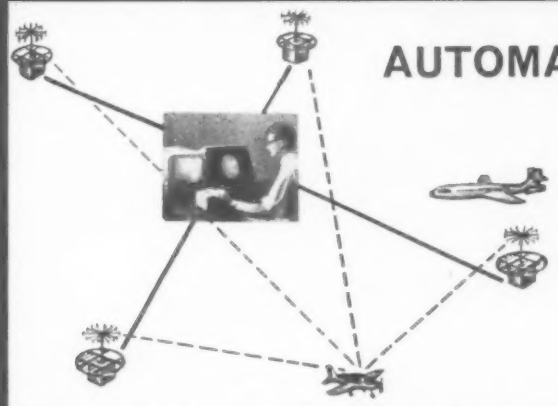
and world aviation



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Detailed information will be sent gladly on request.

May we welcome you to Stand No. 114 (Indoor Exhibition) at the S.B.A.C. Farnborough.

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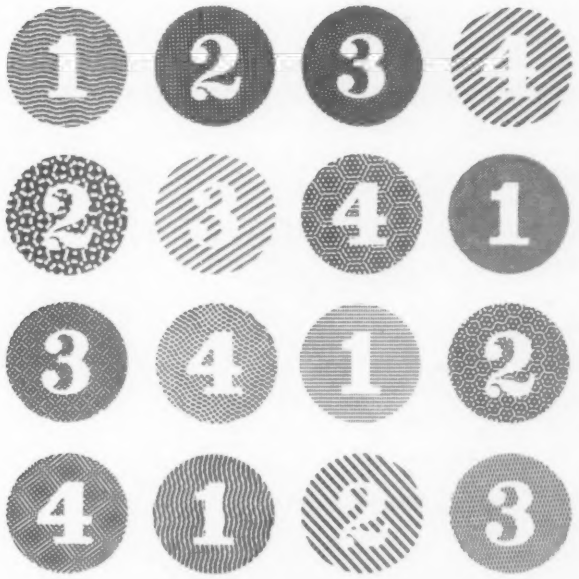

SMITHS

On Stands 1, 2, 3, 4 at Farnborough, Smiths Aviation Division will be showing their latest developments in the field of aircraft instrumentation, including flight control systems, fuel contents systems, flight, navigation, engine instruments and equipment, servos, synchros, gyros and small motors. Straight in at the main entrance, turn left and there you are—SMITHS. It all adds up.

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The system is based on a simple servo positioning control. Auxiliary functions, such as temperature, or speed-controlled acceleration, speed governing, speed synchronisation and automatic air speed control (for use with auto-pilot) can readily be added to the system with minimum modification to the basic units. The positioning sensitivity (0.2% of full throttle travel) ensures easy and precise control of engine power, with negligible backlash.

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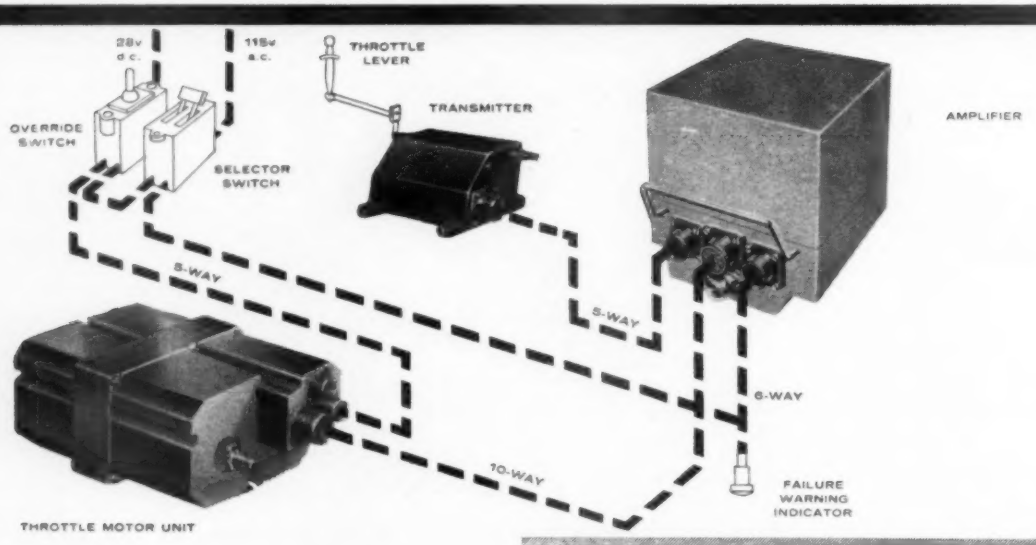
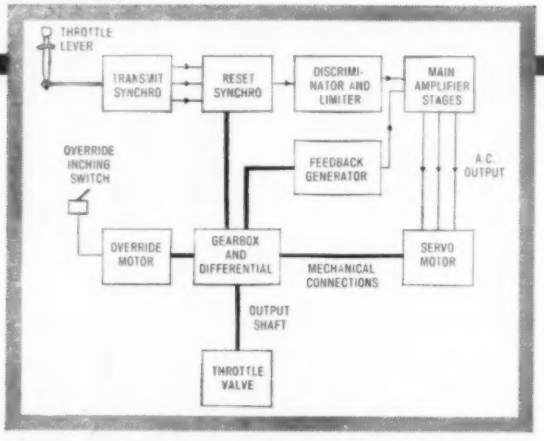
* RELIABILITY



Accurate positioning against widely varying load torques, which may either oppose or assist the motion.
The system is completely free from ambient temperature, altitude and structure flexing effects, and independent of the distance between the flight-deck and the engines.
There is no reaction torque or loading on the pilot's throttle lever, thus giving a smooth adjustment from ground idling to maximum flight power, or, in the case of beta propeller engines, from maximum reverse thrust to maximum flight power.
An emergency override system is incorporated for use in the event of failure of the normal system.



Following the successful application of such a system of throttle control to the Bristol Britannia—some 2,000,000 flying hours have now been logged—we have at present under development similar systems for the Short Bros. and Harland *Belfast* and the British Aircraft Corporation *TSR2*.

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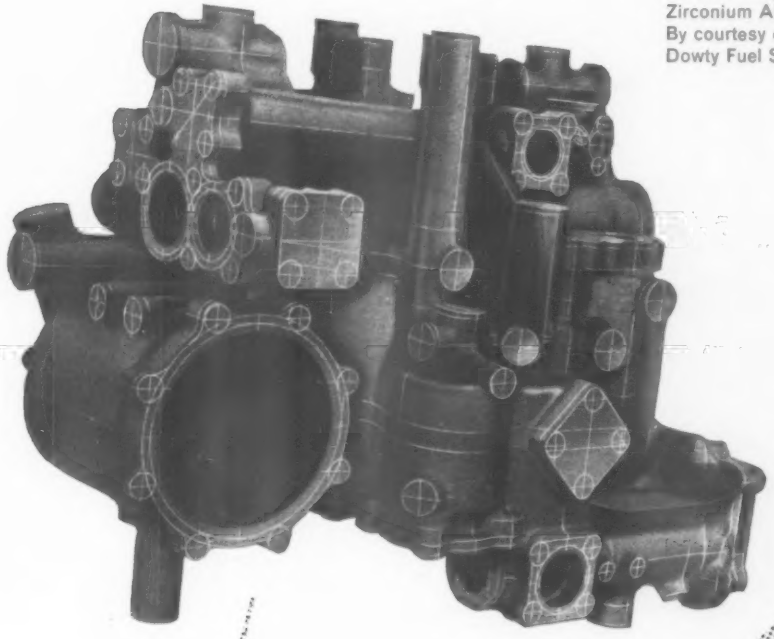

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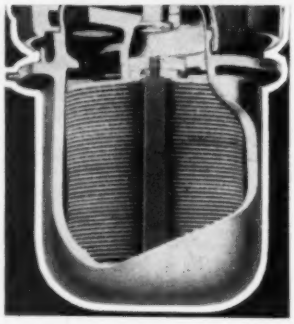

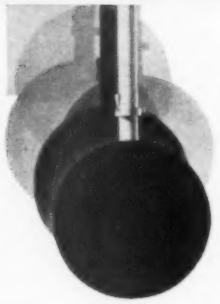

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Palmer wheels and brakes, widely specified for today's light aircraft, helicopters and gliders—and for the unconventional Hovercraft and Brittain Norman Cushioncraft—are the outcome of many years of research and practical development work. No less for the aircraft of tomorrow—for prototype and production—these Palmer facilities are available to the designer.

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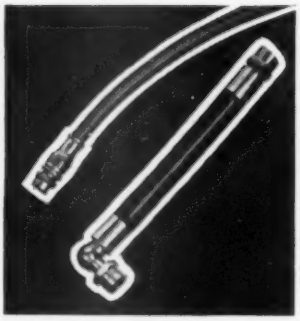

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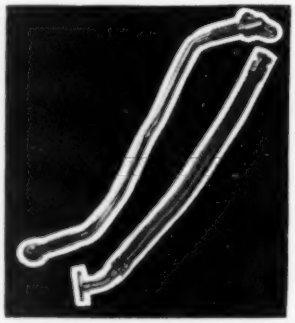

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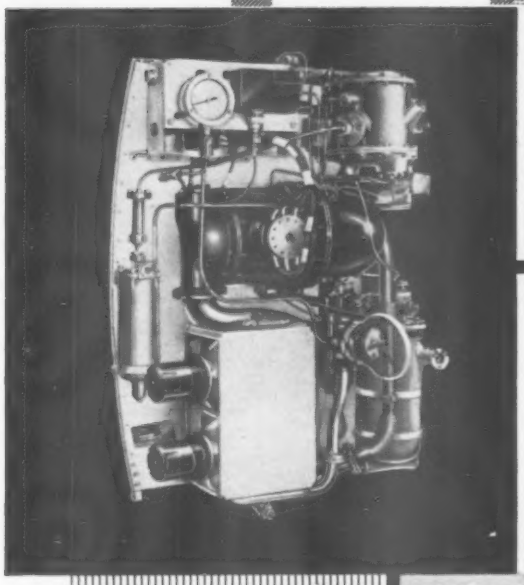

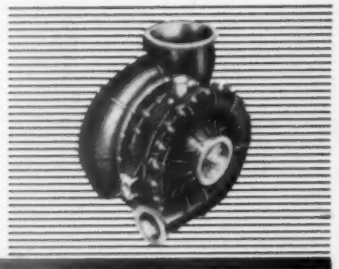

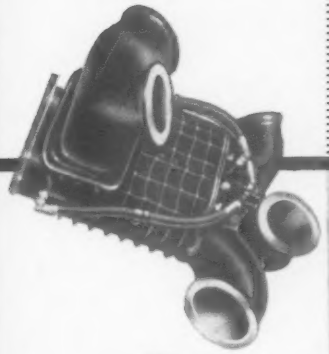

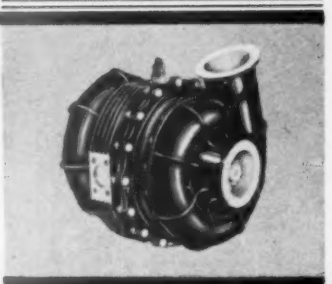

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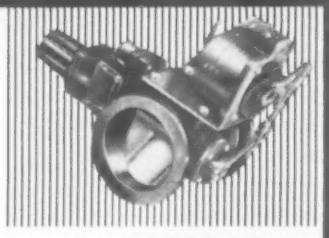

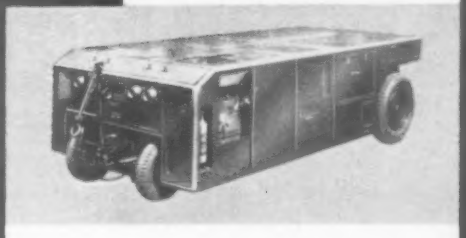

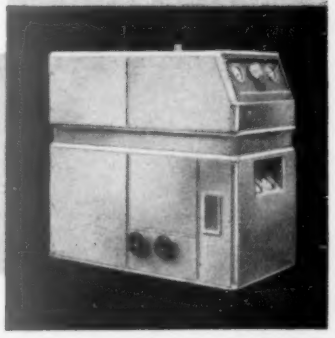

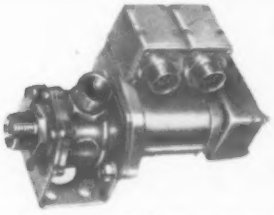

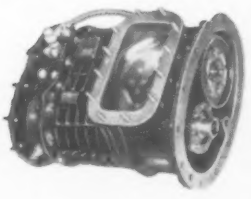

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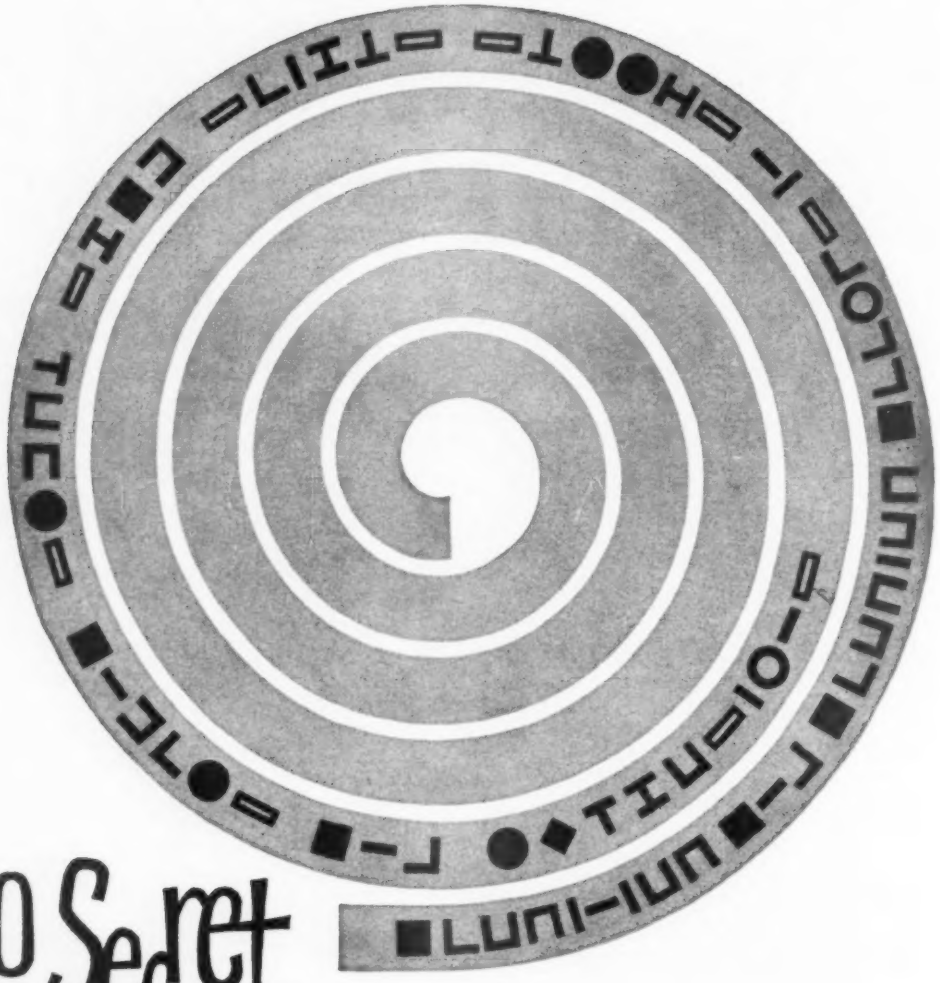

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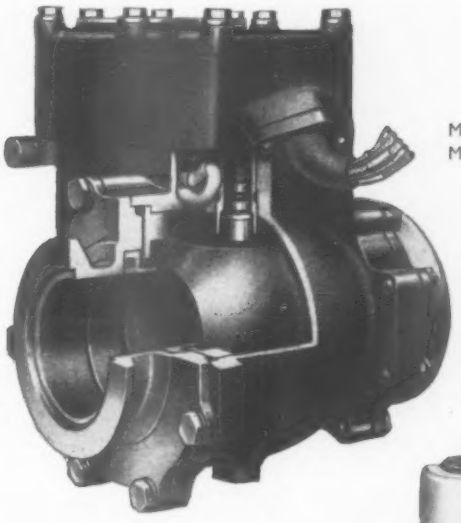

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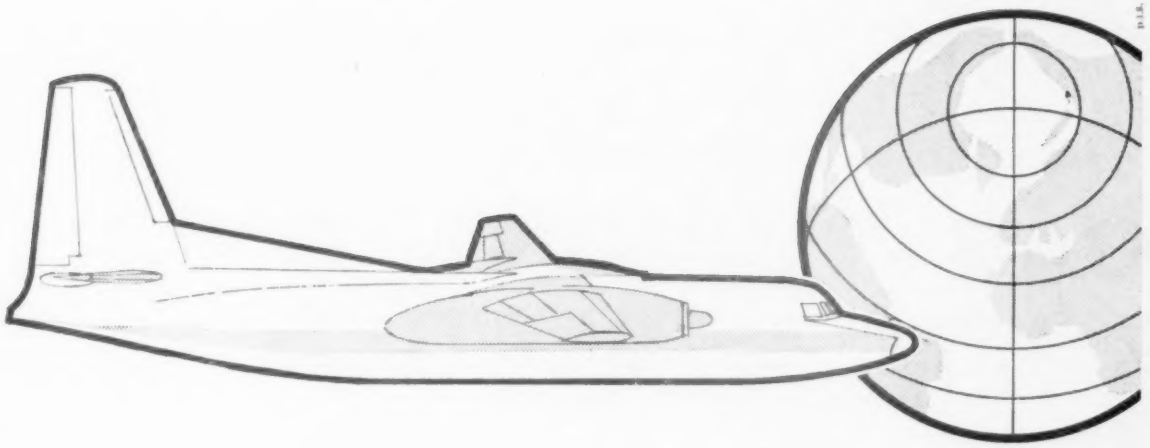

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Der kluge Mann gewinnt erst Freunde und dann Geld. Freundschaften sind wie Perlen, und es ist schöner zu bewahren als zu gewinnen.

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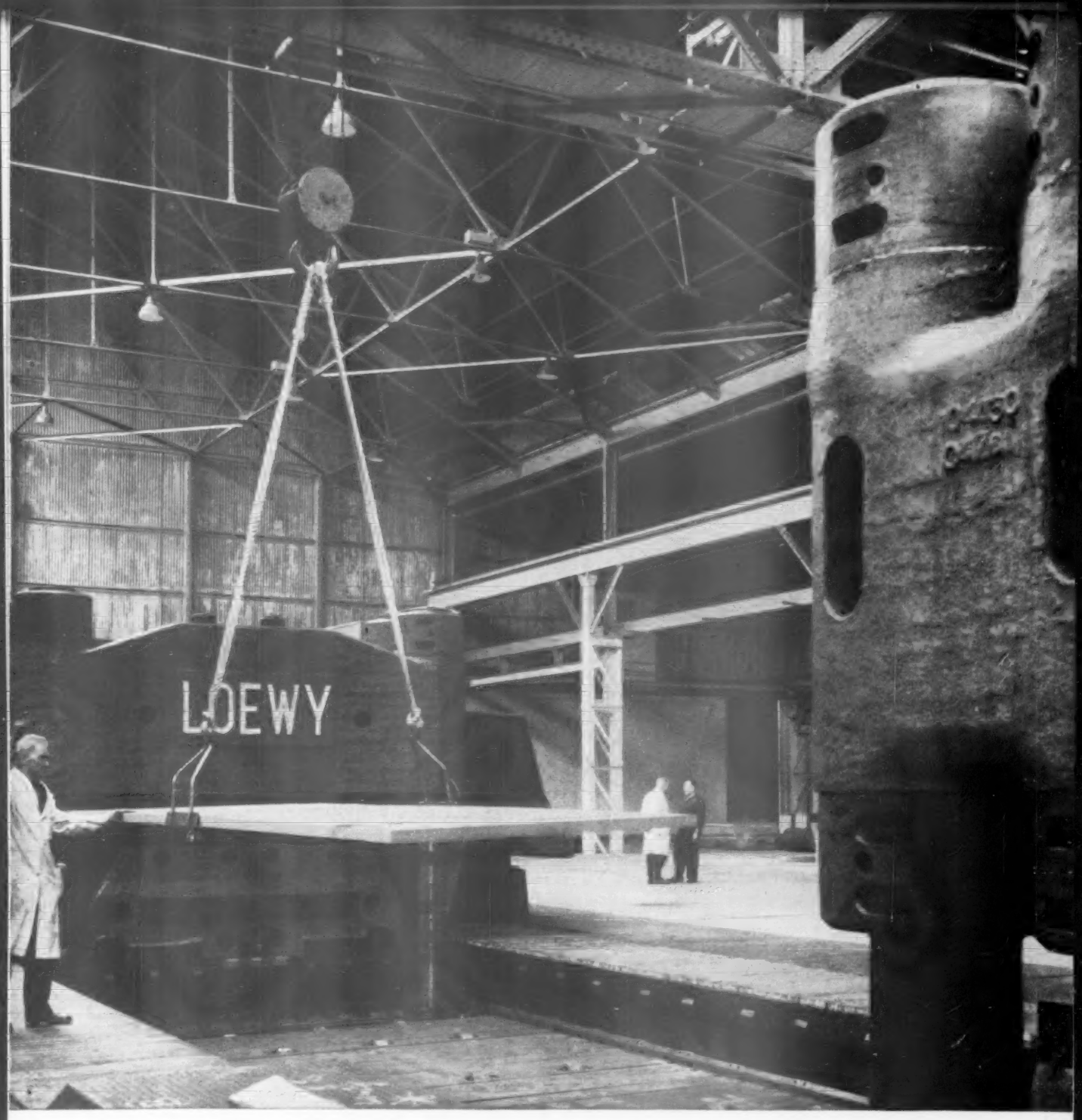

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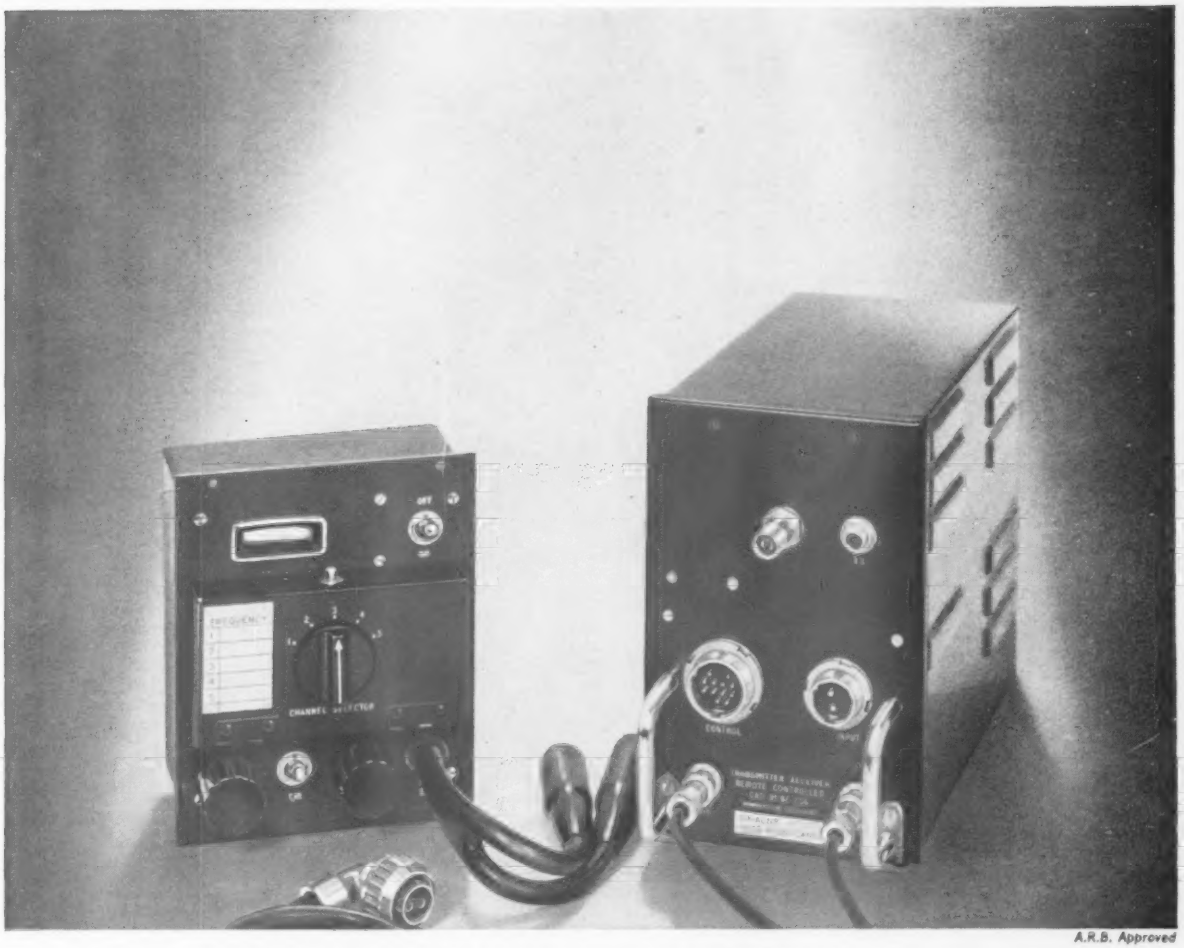

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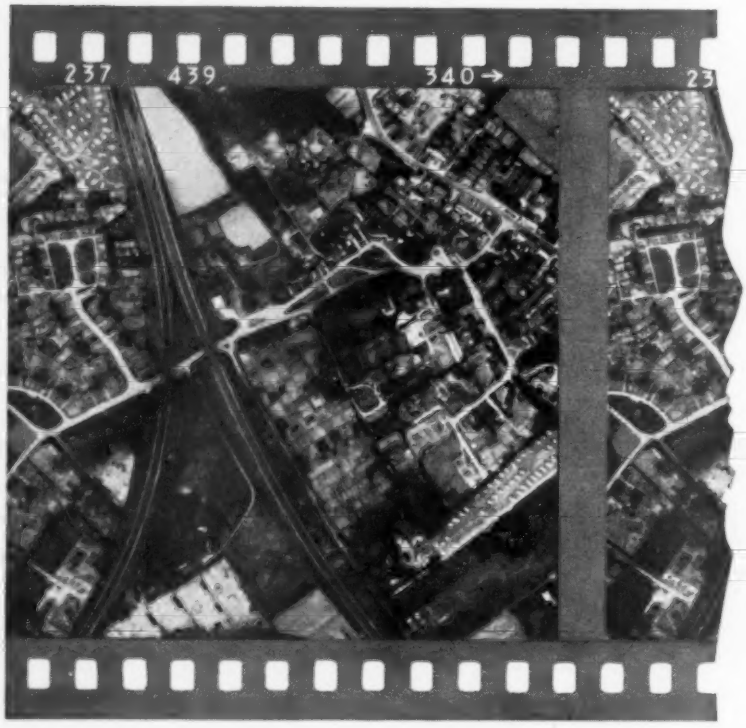

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- Recording of headings and positional information direct on to the film.

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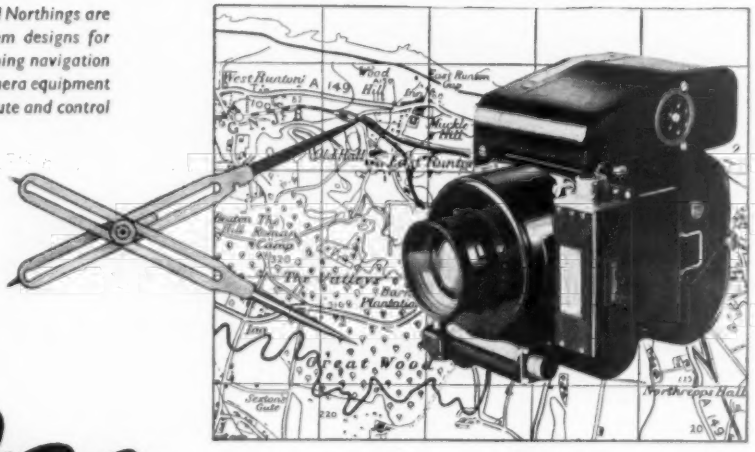

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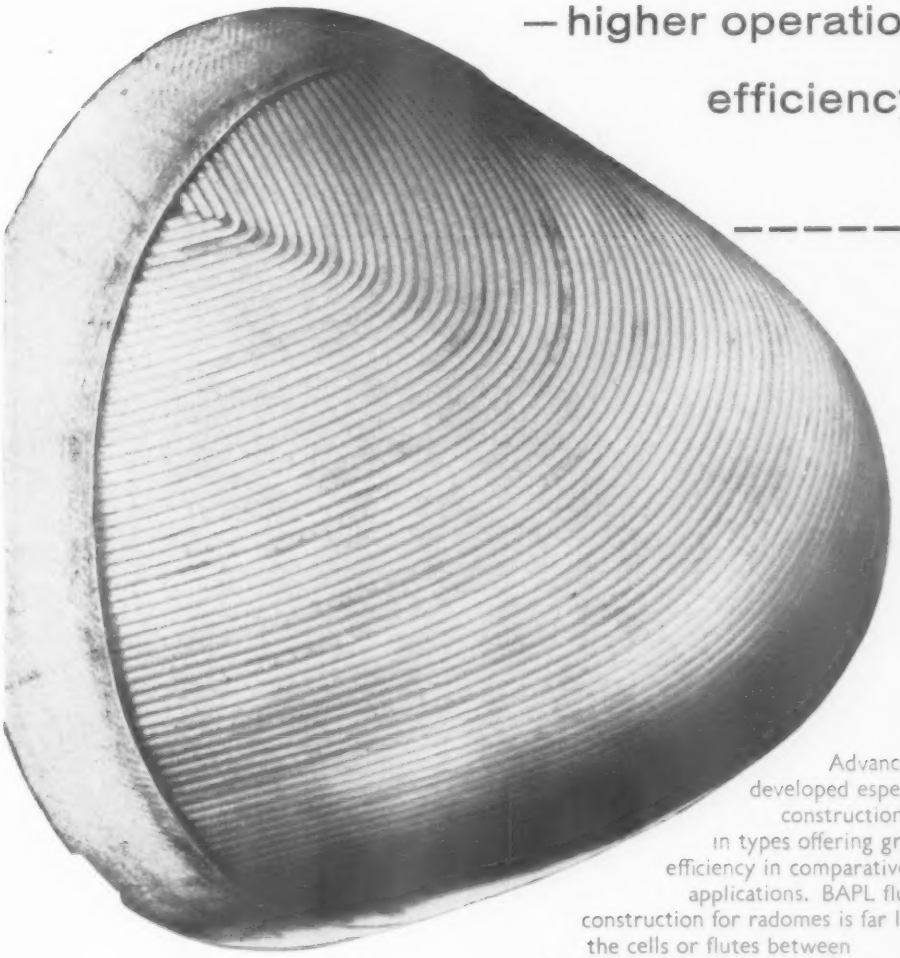

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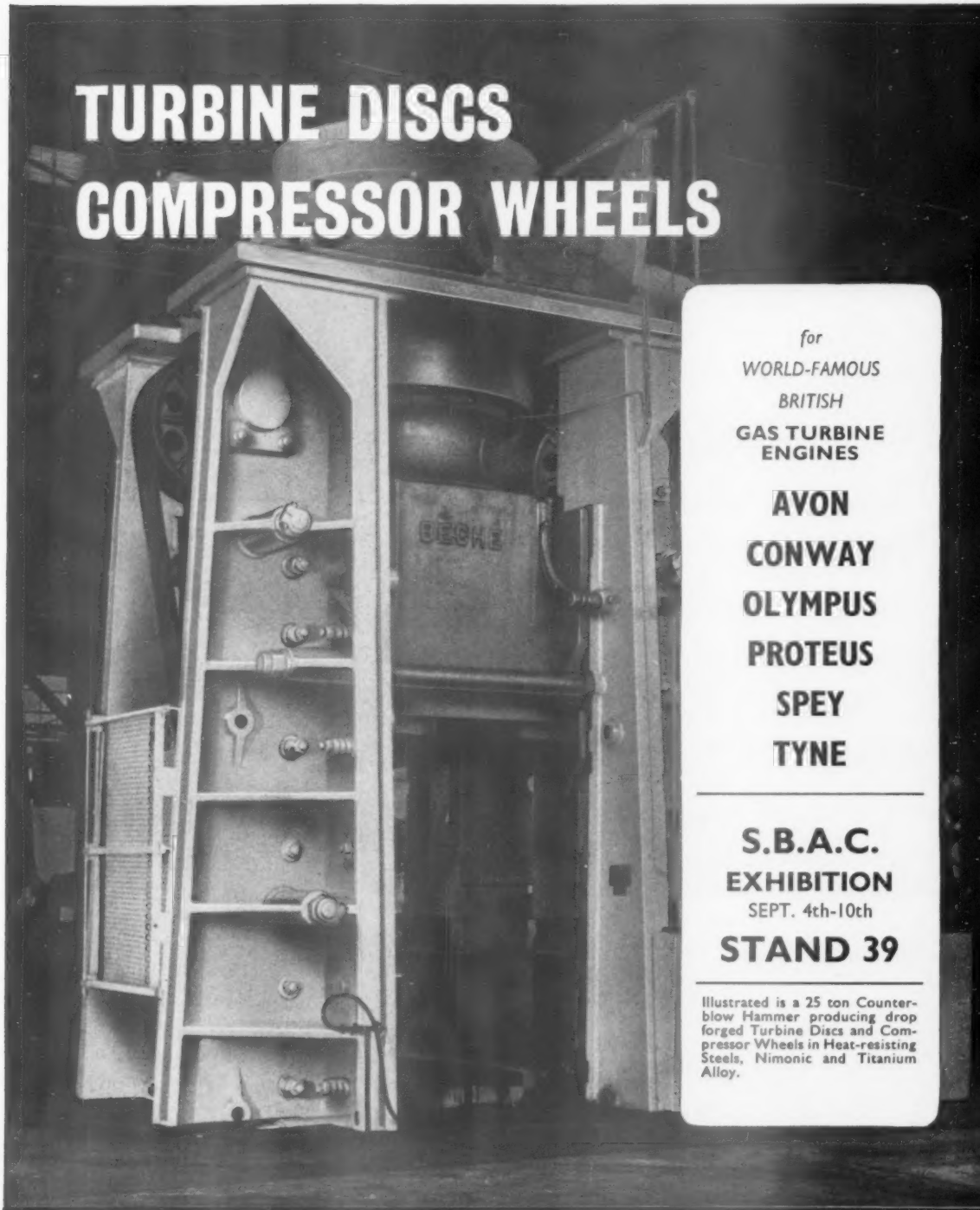

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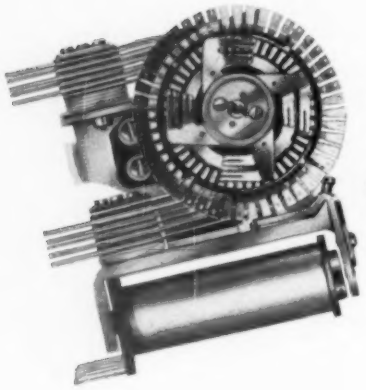
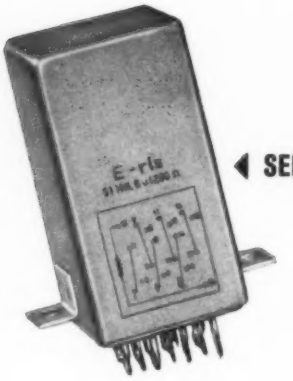
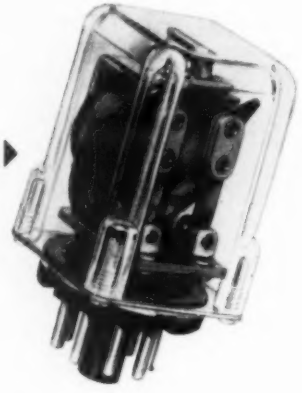


◀ 3 IN 1 RELAY



◀ SENSITIVE D.C. RELAY

PYGMY POWER RELAY ▶



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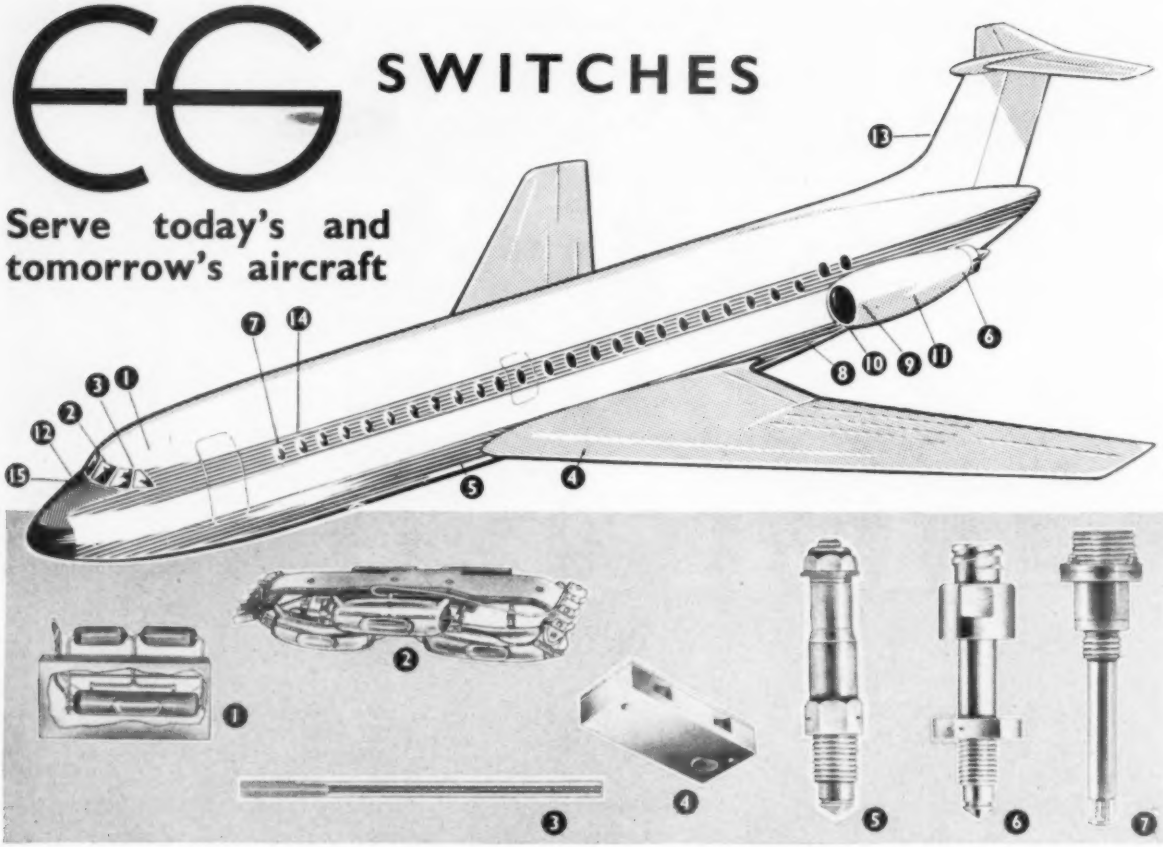

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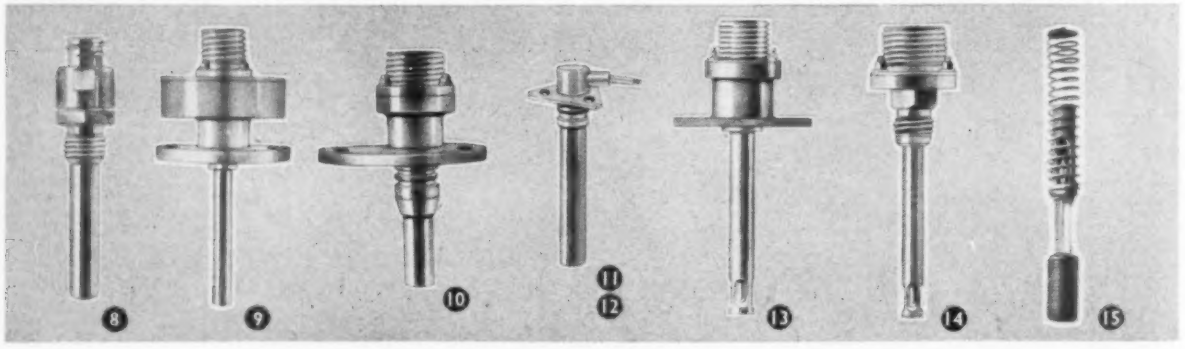

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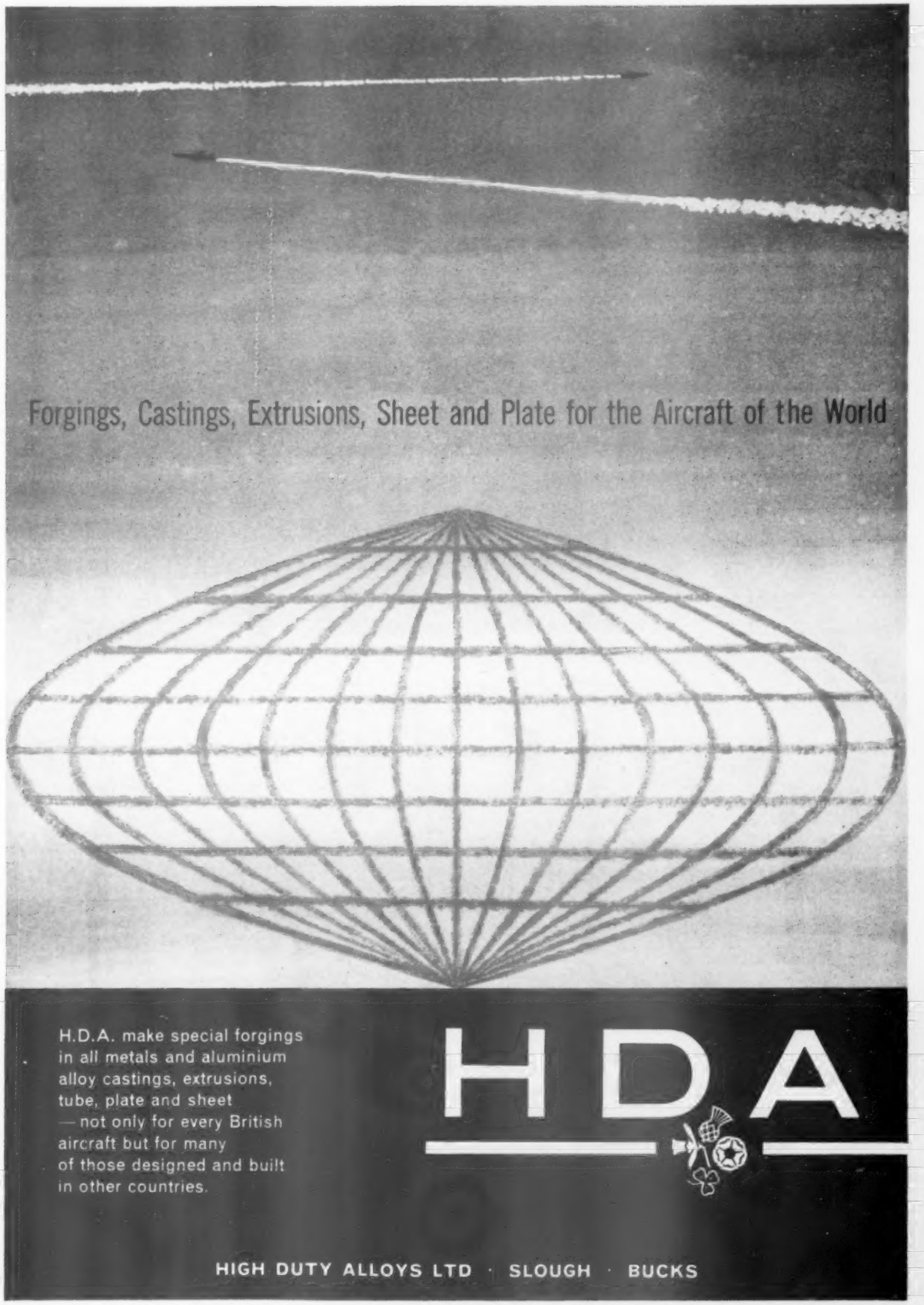
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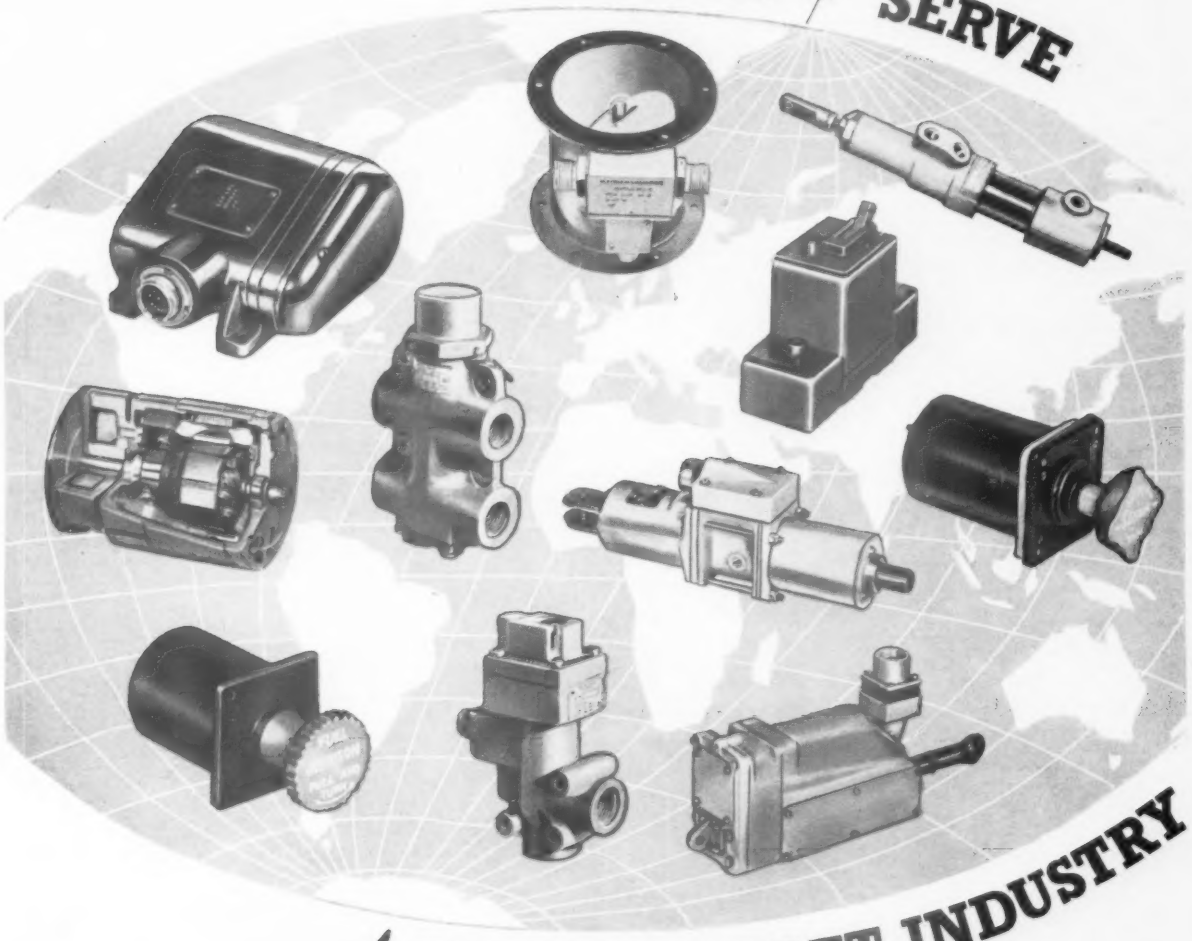

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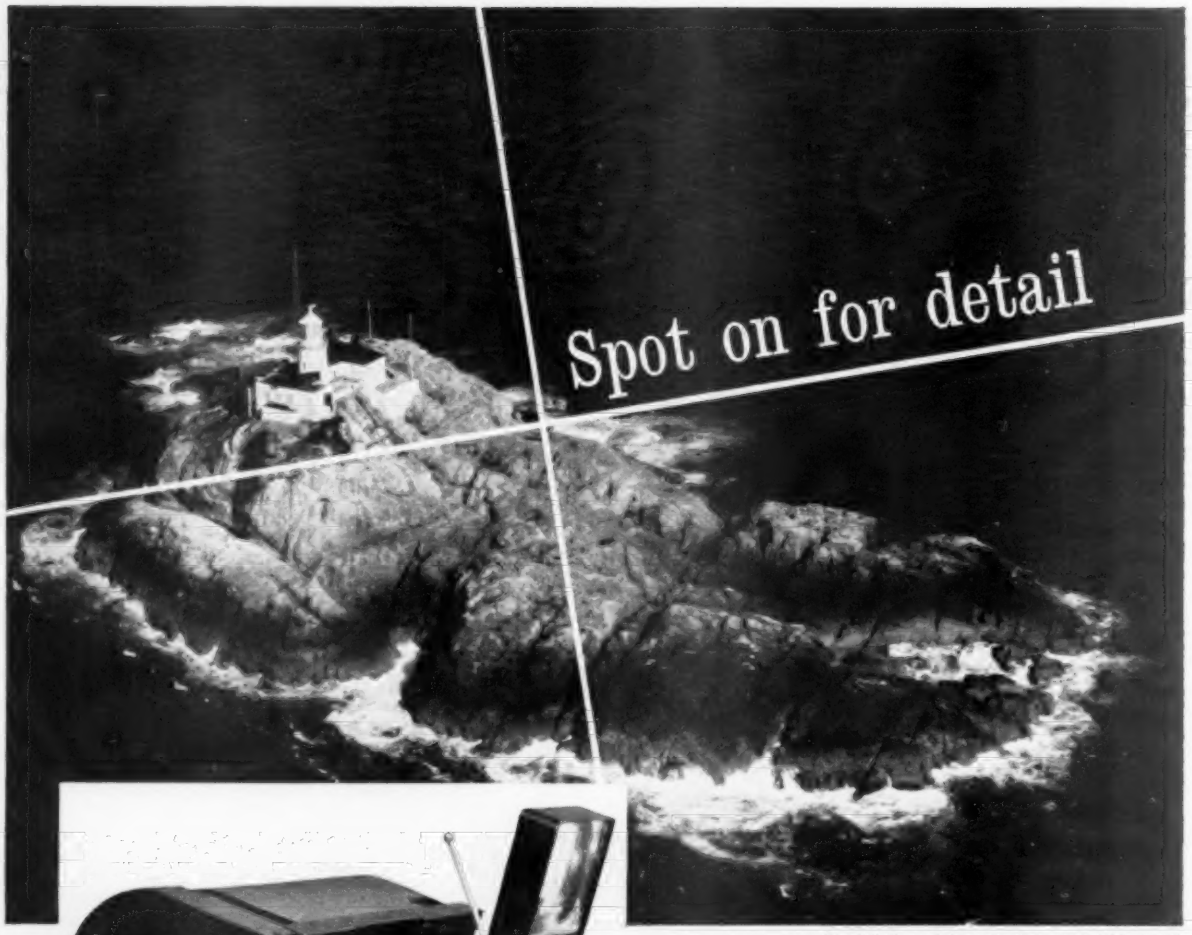

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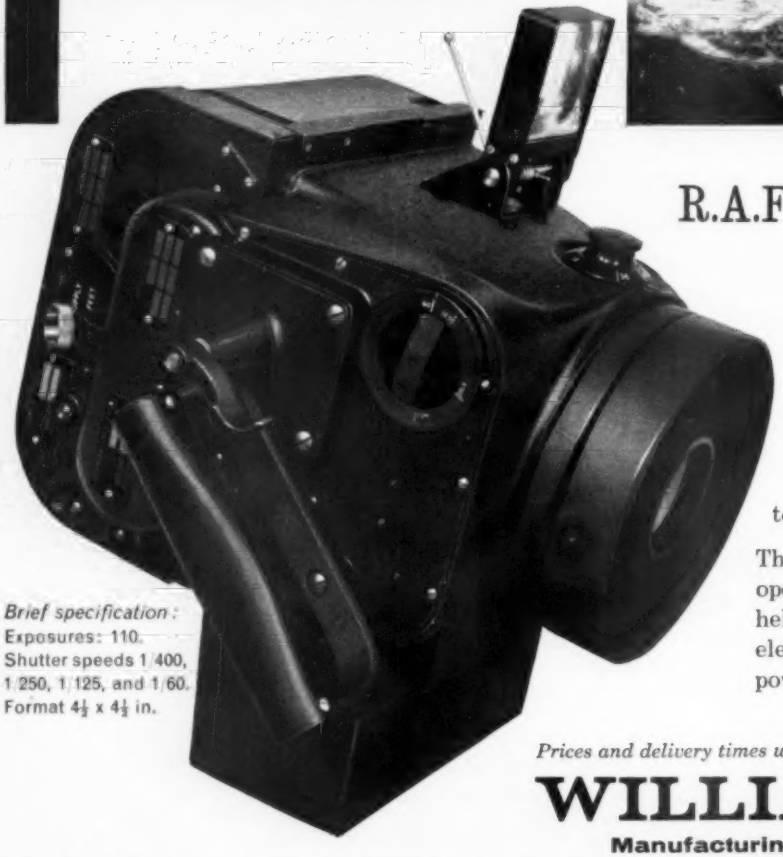

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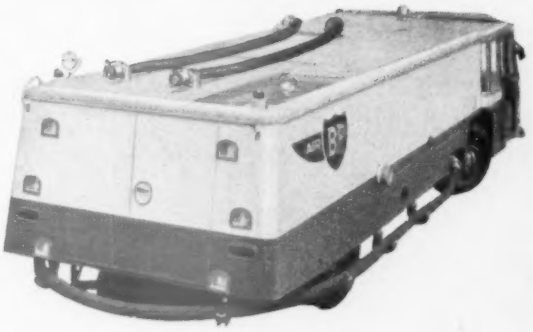

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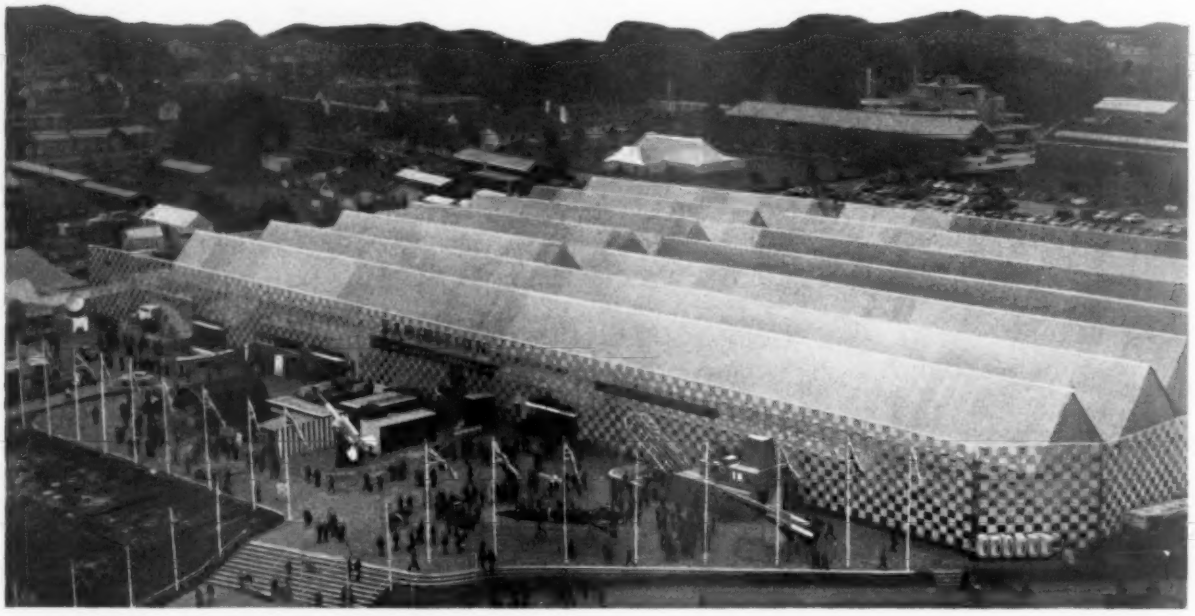

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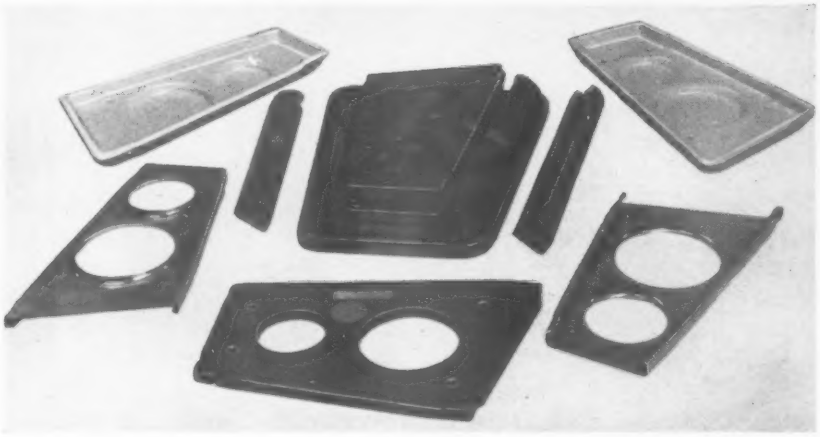

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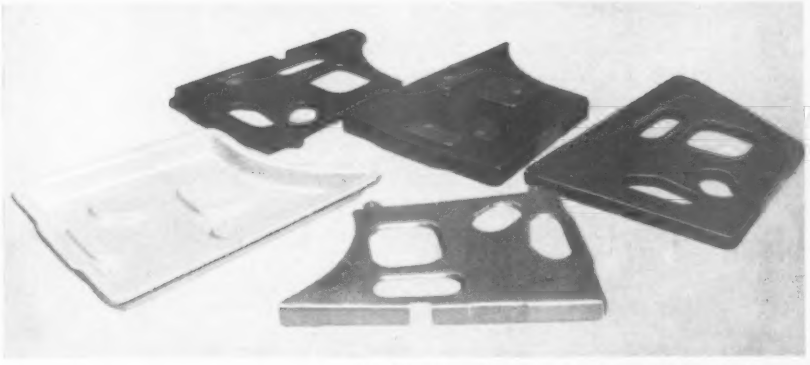

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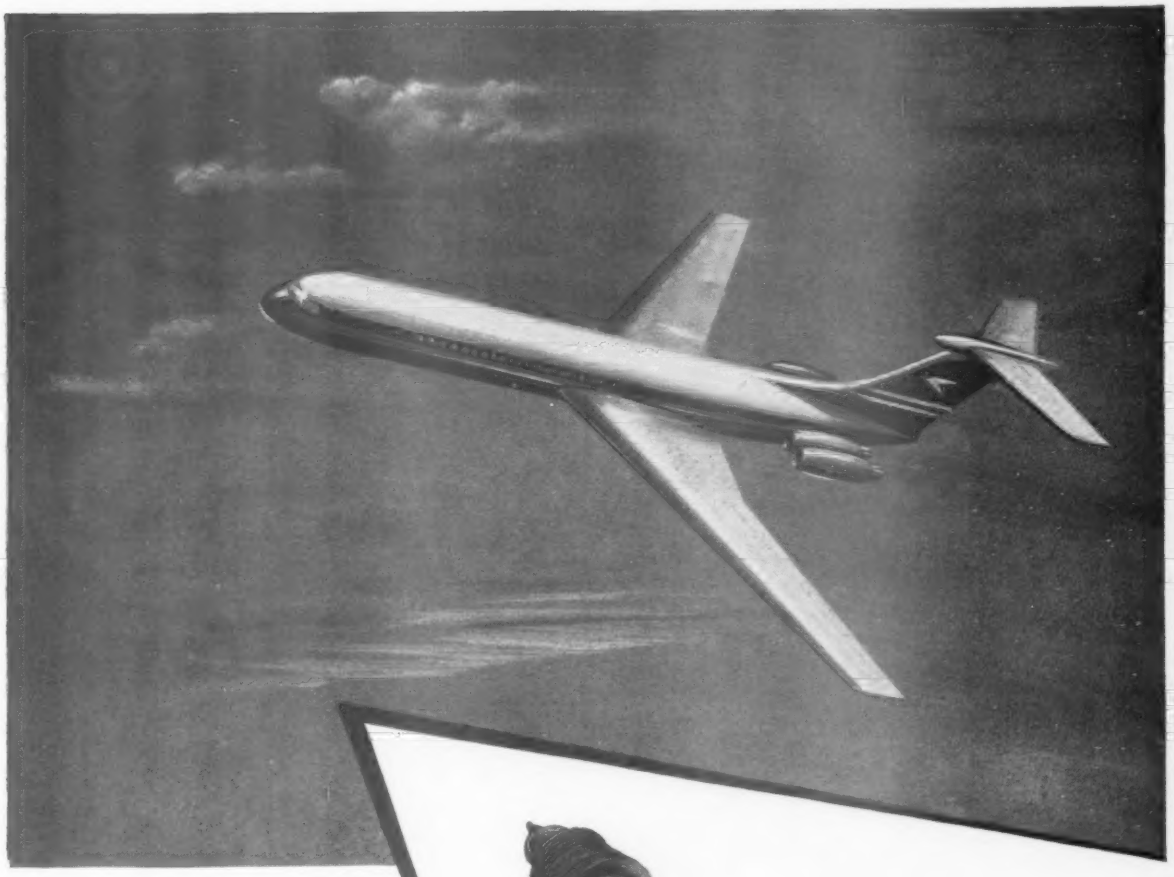

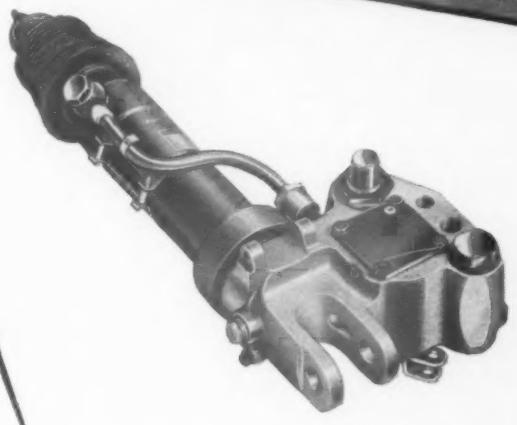

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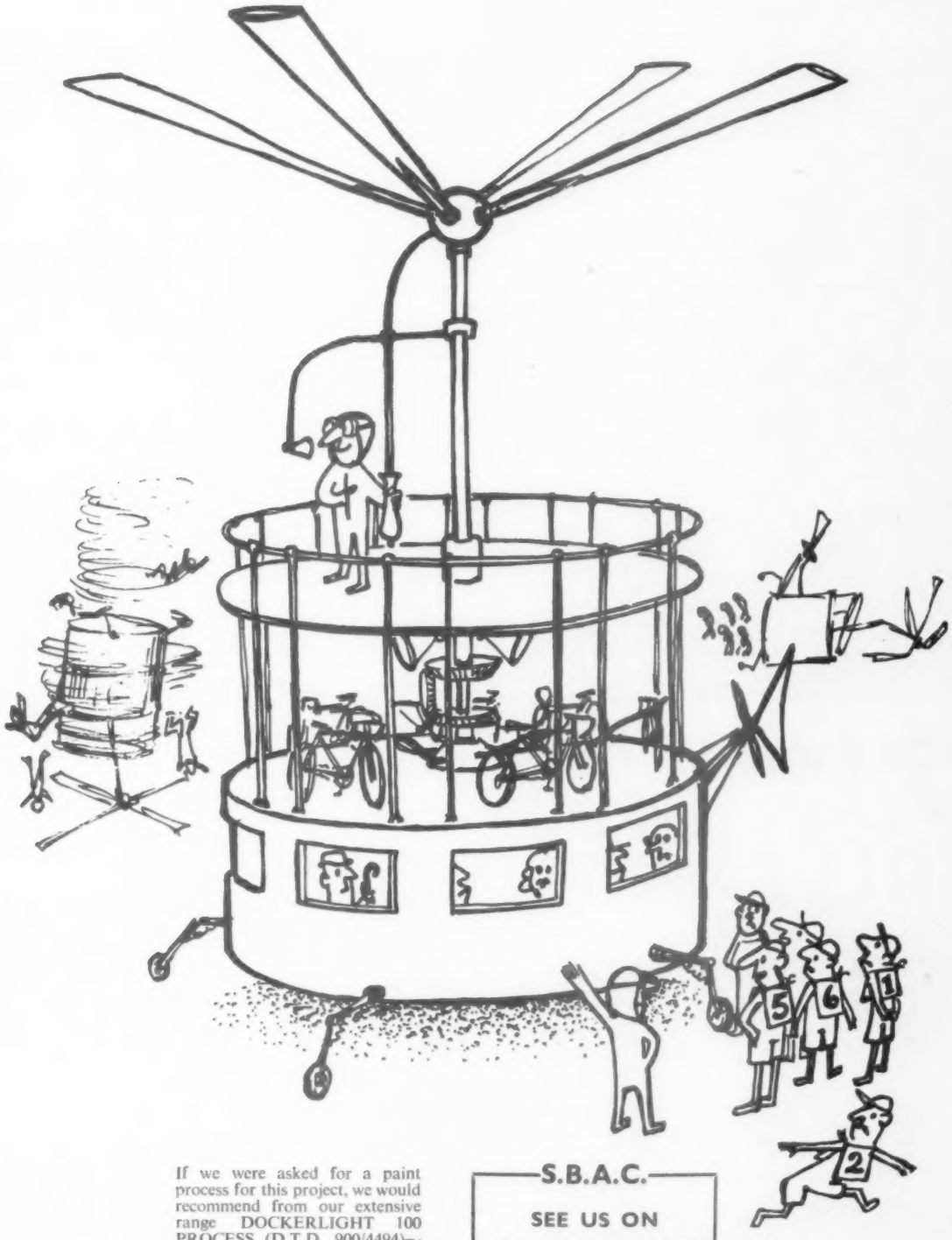

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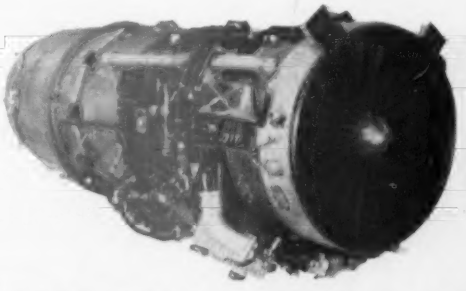

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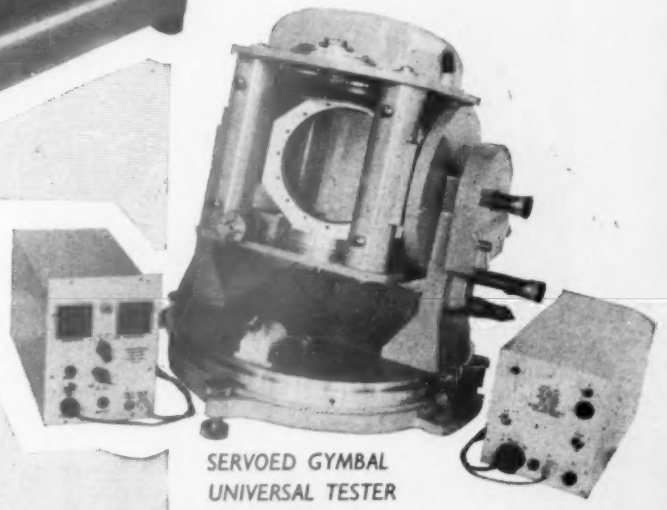

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THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2602 AUGUST 31, 1961

The Ever-growing Display

Last year the S.B.A.C. Show attained its majority. This year the Society of British Aircraft Constructors are able to claim that the "largest tented structure in the World used to house aeronautical exhibits" will be occupied by the stands of members. In actual figures there will be 15 more stands and, at 130,400 sq. ft., the floor area will be up by 5,000 sq. ft. It is perhaps more usual to think about the new aeroplanes that are to be seen than the indoor exhibits, but in fact with the much increased gestation periods of modern aeroplanes it is not to be expected that there can be a flock of new prototypes every year. On the other hand with increasing complexity, the variety and number of installed specialized substructures, systems, components, accessories, and parts must increase. And every year the space required for their display goes up. This emphasizes the increasing trend towards specialization.

In this issue we have made our annual attempt to catalogue and illustrate the products of the British Aircraft Industry—an industry which, gaining new strength from its reorganization, is not only employing more people but is ringing the bell in the matter of exports. The figures for the half-year to the end of June last were higher than those for the half-year of 1959 in which the year's total air exports reached an all-time high at £156 million.

The new field opening up for earning money in space will be indicated at the Show by the first public display of the de Havilland Blue Streak in which confidence is growing as the likely launcher of the first European communications satellite. The vigorous attack now being made in the most promising field of general aviation will be demonstrated by the Beagle exhibits, chief among which will be the B.206, the executive aircraft with built-in airline experience.

That the supersonic airliner field is under survey by the British Industry will be made apparent by the Handley Page H.P.115 slim delta, with which exploration of the landing and take-off behaviour of this bi-sonic shape is to be undertaken.

The full range of aircraft, powerplants, missiles and all other exhibits will be found listed in the appropriate part of this issue. It is to be regretted that among the aircraft not on show will be the Carvair modification by Aviation Traders which, starting with the basic DC-4 structure, produces a nose-loading freighter of wide potentiality. The new Beagle-Wallis gyrocopter will not be seen either. Both for the reason that the basic structures are not British.

Those people, and they get fewer each year, who recall that the S.B.A.C. Show grew out of exhibits at the R.A.F. Hendon Air Display, will have the warmest of reasons for welcoming participation by the three Fighting Services. A link with those days will be the appearance for the first time at the Farnborough Show of Army parachutists. Not only will all visitors welcome this participation for the show of virtuosity provided, but equally they will be impressed by seeing the products of the British Aircraft Industry in action.

We will conclude by greeting with much warmth all those visitors from overseas who have come to regard the S.B.A.C. Show as the high spot of the aeronautical year.

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Matters of Moment

Farnborough Fare

IN this issue, in addition to our annual review of the products of Britain's aircraft industry, we have devoted a large amount of space to a preview of the exhibits that are to be found at the S.B.A.C.'s 22nd Air Display and Exhibition which opens at Farnborough next week. Once again, there is to be a Press Preview and Technicians' Day on the Monday, Sept. 4, prior to the official opening day which is on Tuesday, Sept. 5. These and the following two days are the "trade" days of the Show week on which the Society and its member companies entertain their guests.

On the first of the three "public" days, Friday, Sept. 8, admission to the Show will be £1 for adults and 10s. for children under 14. Parking fees for vehicles on this day are: cars and motor coaches £1; motorcycles, 5s.; and pedal cycles 2s. 6d. On the Saturday and Sunday, Sept. 9 and 10, admission charges will be 5s. for adults and 2s. 6d. for children. The charge for a motorcar with up to six passengers will be 30s. and parking fees for motor coaches, motorcycles and pedal cycles will be 10s., 2s. 6d. and 1s. respectively.

The Farnborough gates will be open from 10 a.m. to 7 p.m. on each day and the flying programme starts at 3 p.m. On these public days as a curtain-raiser to normal flying programmes for the industry's products, four Turbulents will be put through their paces. A special item on this programme for Saturday will be a demonstration of runway-level Martin-Baker ejection seat operation.

Service participation in this year's flying display will be on a larger scale than ever before. Some 140 Royal Navy, Army and R.A.F. aircraft are taking part in formation aerobatic displays, toss-bombing and in-flight refuelling demonstrations, and formation take-offs and stream landings. The Army and the R.A.F. are planning to stage a combined land-air assault on the control tower and (weather permitting) 40 Bomber Command V-bombers and Canberras will fly over at contrail height.

At the start of the overall flying display, a Fleet Air Arm photographic reconnaissance Scimitar will take off to photograph the President's tent and other features on the airfield. Before landing 30 minutes later, the aircraft will take low-level shots of the carrier "Hermes," and these photographs will be exhibited at the show before the flying programme is concluded.

Four Army Skeeters will open the Services' show with low-level formation exercises. These will be followed by a delayed parachute drop by six S.A.S. parachutists from Army Air Corps Austers.

A Scimitar and a Sea Vixen will then introduce the full F.A.A. display with a demonstration of toss-bombing. This will be followed by a buddy in-flight refuelling demonstration by a pair of Scimitars or a pair of Sea Vixens. Nine Scimitars of No. 800 Squadron will then give a display of formation aerobatics followed by a stream landing. Finally, 10 Sea Vixens, five Scimitars and four Gannet A.E.W.3s. from H.M.S. "Hermes" will stage a formation fly-past.

The flying display will conclude with a 30-minute programme by the R.A.F. The main item of this is to be a large-scale demonstration of tactical transport operations by No. 38 Group, Transport Command. This event will begin with a simulated attack on the control tower by eight Hunter FGA.9s followed by a landing of an assault party by six Whirlwinds and Belvederes. After the departure of the helicopters there will be a landing of troops and vehicles by Beverleys. The assault party will then be supplied by the helicopters which will return with underslung loads. Pioneers and Twin Pioneers will demonstrate supply-dropping and these aircraft will land for a simulated casualty-evacuation.

In addition to No. 38 Group's demonstration, the R.A.F. will provide three aerobatic displays. The first of these is to be by "The Blue Diamonds" Hunter F.6 aerobatic team of No. 92 Squadron; Lightning F.1s of No. 74 Squadron will provide the second item, and the third will be by four Flying Training Command Jet Provost T.3s of the Central Flying School, R.A.F. Little Rissington. Six instructors of No. 1 Parachute Training School, R.A.F. Abingdon, will give a demonstration of free-fall jumping from a Beverley and the final item will be the Bomber Command fly-over.

NEW AT THE SHOW.—Two specifically new aircraft which will be seen at next week's Farnborough display. Above is the H.P. 115 slim-delta research aircraft and below is the Beagle-Masefield B-206 executive twin. Last-minute news suggests that the Bristol 188 supersonic research aircraft may make a flying appearance on one or more days.

The Beagle-Wallis Autogyro

BRIEF details have been issued of the first venture by the Beagle Group into the rotary-wing field in conjunction with Wg. Cdr. K. H. Wallis, R.A.F. Wg. Cdr. Wallis, who is a serving officer at Boscombe Down, has developed the little single-seat WA 116 from an initial exercise started in 1957 on the basis of a similarly small American design, assisted by the Miles division of the Beagle Group.

The new WA 116, which has been flying for some time, differs considerably in concept from the "do-it-yourself" approach of the American gyro-copter. It has been engineered to produce a practical, reliable, single-seat autogyro for serious operational tasks, on the basis of the extensive all-round experience gained by Wg. Cdr. Wallis in this field.

The single photograph so far released (see page 223) shows it to be built round a tubular alloy airframe of very simple structure, with its 65 b.h.p. McCulloch flat-four two-stroke engine in the usual pusher installation. A large measure of refinement is apparent in the rotor hub and control system, which has contributed to the remarkable standard of stability achieved in the WA 116. It will fly quite happily hands and feet off, and its level-flight speed range is 10-70 knots. Take-off run in zero wind is about 25 yards, and the initial climb is more than 1,000 ft./min.

Other data are: rotor diameter, 20 ft.; length, 9 ft. 6 in.; height, 6 ft. 1 in.; track, 5 ft.; and gross weight, 580 lb. The WA 116 will be represented only by photographs on the Beagle Group stand at Farnborough.

Automatic Landing Forum

MUCH good should come from the BALPA-organized forum on automatic landing, to be held on Oct. 31 next in the form of an all-day discussion. The forum will be initiated by short papers dealing with various aspects of the work now being done in Britain in this field. They will include a presentation on the opinions of Smiths Aircraft Instruments, probably by Mr. A. M. A. Majendie or Mr. K. Fearnside; a short paper on the Elliott Brothers VC10 system; a review of operators' requirements by Capt. F. Ormonroyd of B.E.A. and a paper on the contribution of the simulator designer, by Mr. D. Wilson of G.P.S., Ltd.

BALPA's policy on automatic landing will be put to the meeting by Capt. P. E. Bressey, whose paper is to be circulated in advance to all those expected to attend. Invitations have been extended to the principal British companies concerned with the design of automatic approach, landing and taxi-ing equipment, and to representatives of Government Departments, transport aircraft manufacturers and airlines.

FARNBOROUGH FORETASTE.—This air-to-air picture, taken last week, shows the Hunters of No. 92 Squadron's formation aerobatic team in action during a rehearsal for Farnborough. Known as the Blue Diamonds, this team has replaced the Black Arrows—No. 111 Squadron.

Photograph copyright "The Aeroplane and Astronautics"

High Success and Low Failure

THE encouraging verdict on Explorer XII, which was launched into a highly eccentric orbit reaching more than 50,000 miles into space on Aug. 15, is that "it has already sent back more information concerning radiation in space than any other satellite." The 83-lb. vehicle is expected to have a useful life of about one year.

Details of the project were given in our article, "Probing the Radiation Frontier," last week. It has since been determined that the orbit actually achieved ranges from 180 miles at perigree to 57,800 miles at apogee. The orbital period is 26.4 hr.

At a Press conference in Washington a week after the launching, NASA reported that ground stations had already filled "many miles" of magnetic tape with information telemetered from the satellite. It was considered that this would be immensely valuable in determining how to protect human astronauts travelling through the radiation belts which girdle the Earth and from other forms of energetic radiation encountered in outer space. This, of course, is particularly relevant to the design of the three-man Apollo lunar spacecraft for which NASA expects to place contracts later this year.

While the performance of Explorer XII has been extremely gratifying, that of the experimental space-probe, Ranger I, launched on Aug. 23, has been rather disappointing. This appears not to have been due to any fault in the spacecraft itself but rather to the functioning of the restartable Agena-B top stage which was to have formed an orbital launching platform for sending the 675-lb. probe more than half a million miles into space (THE AEROPLANE AND ASTRONAUTICS, Aug. 3, 1961, pp. 132-133).

The plan had been to place the Agena vehicle, with the spacecraft still attached, into a parking orbit close to the Earth. After it had assumed the correct orientation, the engine was to have been restarted after a period of 13 minutes to launch the probe on the desired departure trajectory. What happened apparently was that the Agena engine restarted but almost immediately closed down; it was meant to fire for 90 seconds. The result is that a rather "perplexed" space probe has been left circling the Earth in an orbit which ranges between 105 and 312 miles. Its sensing devices, which should have locked on the Sun and worked small gas-jets to keep the probe facing in the right direction, are "completely fogged" when the vehicle enters the Earth's shadow.

Ranger I's instruments were primarily designed to measure radiation and micrometeorites in deep space. It is, as one authority put it, "a very mixed-up piece of machinery."

Hovercraft Service Plans

NEGOTIATIONS for the construction and supply of a large, new type of hovercraft suitable for use on the routes for which Starways have applied, are going on between the Liverpool airline and two engineering firms.

The applications will come before the A.T.L.B. towards the end of this year. They seek authority (as already reported—see our issue of Jly. 20, p. 64) to operate hovercraft seating between 20 and 100 passengers, which are expected to be available within the next two years. Ald. F. H. Wilson, chairman of Starways, said recently that negotiations had reached "the drawing-board stage of what we believe is the ideal craft which will be needed to be a paying proposition." He envisaged a craft that could be used as a vehicle ferry with passenger accommodation—capable of carrying 12 cars and about 100 passengers.

As already recorded, Starways had previously announced that they plan to place orders for what will eventually be a fleet of 14 hovercraft capable of carrying 100-150 passengers at a speed of about 75 m.p.h. Liverpool Airport would be the first base, with a second base at Glasgow.

OPtional Reading—9

HE who writes of Russia writes rashly. If this has not been said before, then it should be said now for, in spite of the opening up of the country to the traveller, not very much information is available on Soviet civil air operations. Perhaps, therefore, it is permissible to do one's best with what first-hand material one has and hope to arrive at a reliable assessment by trial and error methods. After all, the P.A.A./Aeroflot agreement, now initialled, must eventually be signed; we shall thus enter on a new phase of competition on the great trunk routes of the World and cannot afford to delay in taking some measure of it.

First of all, with regard to the size of the fleet, this figure has just been published by *Aviation Week* as 2,000 aircraft, of which 200 are jets or turboprops. Taking into account the following somewhat crude material which I have gathered—a total aviation work force of about 300,000 (including aircrew, maintenance personnel and a few services such as Met. and A.T.C.); an allowance for special operations, such as fishery survey and agricultural flying; the number of passengers carried (20 million in 1959, now probably 26 million); the length of the trunk routes; the density in the terminal areas as shown by the ground radar scope—I estimate the total civil pilot force at 7,000. In accordance with the trial and error method mentioned above, I should be glad to be corrected on this figure.

The question is: how will these aircraft and these crews be expanded and adapted to cover the anticipated increase in international operations? But before answering this it may be as well to pay a little attention to Russia's own point of view on the desirability of expansion in the international field, because there is plenty of room for expansion in the domestic field and she has got by, more or less satisfactorily, with her present somewhat limited international services. It is not only the power to expand the international commitment but also the wish to do so which is important, and here the answer is not quite straightforward.

If, as you leave Sheremetyevo airport, you wish to spend your spare roubles on a Russian doll from the trinket stand, you will find that they are unacceptable and that only foreign currency will be taken. This is significant and clearly indicates an acute shortage of foreign exchange. International air operations will be of value if they bring in foreign exchange in the way of tickets sold and foreign tourists paying hotel bills. But both of these have at present rather strict limits.

The existing runs seem to carry an unusually high percentage of officials and these, so far as the country as a whole is concerned, would bring no net currency gain. The tourist industry (for reasons I will not go into now) has not built up as expected, except perhaps group tours originating in the Soviet currency area. So the gains from this source are small.

This leaves prestige as a motive rather than profit. Here Russia, like most other countries, will clearly be prepared to pay a price. But in my view it will be a limited price. In other words, I do not subscribe to the theory that, in a year or two, Aeroflot's expansion *on international routes* will be phenomenal. Undoubtedly it has the power to expand, but, for reasons which will be further developed in a later article, the effort is likely to be in the domestic rather than in the international field.

Let us now go back to the questions of how the aircraft and crews will be expanded. For the really long-haul work the Tu-114 is already in operation domestically and will presumably be the first Russian aircraft on a regular Atlantic run; the Tu-104B and the Il-18 will take care of medium-haul domestic and international routes; and the new Tu-124 (a smaller version of the 104, especially adapted to use short field lengths), together with the fixed undercarriage turboprop maid-of-all-work, the An-10, will look after the short-haul traffic. There is also the smaller An-24 (32 seats) in the offing, but this will be essentially a "regional" aircraft. The U.S.S.R. appears to have no *specially designed* civil freighter aircraft.

Bearing in mind the state of development and production reached in the military field, as demonstrated in the display of Jly. 9, and assuming that there is a relation between this and the civil field, Russia will have no difficulty in developing these aircraft in numbers and design so as to cater for its new domestic and the international operations. The competitive value of the Tu-114, the principal runner against, say, the turbofan DC-8 in the international race, must, however, be regarded as problematical. But perhaps a civil version of the Bounder will come along to capture those 100 knots which are the selling point of long-distance travel.

The supply of crews seems likely to be tighter than the supply of aircraft. Several factors tend to limit the rate of expansion which can be applied here. The standard crew for long-distance operations is five (captain, co-pilot, navigator, flight engineer and radio officer), a rather large unit these days; a typical conversion course takes six months; the crew flies a maximum 60-hour month; it flies as a unit and, if one member is unfit, all are temporarily grounded (with a crew medical *before each flight* (sic) this could be important); it has 60 days (paid) leave per year. Now the above may be very good principles but they do not make for a quick retraining programme; and they do not make for a highly competitive bid on the main trunk routes of the World.

But I wish them luck and will deal in a later article with the domestic field where the position is entirely different.—C.C.J.

Flight Deck Computations

DURING the past few years the G.E.C. Applied Electronics Laboratories at Stanmore and R.A.E. Farnborough have been co-operating in an investigation into the use of airborne digital computers for aircraft navigation and general flight management calculations. This work has resulted in the development of a digital experimental airborne navigator known as Dexan which was built to gain experience of such electronic techniques in an airborne environment.

The basic design of the system was worked out by G.E.C. in conjunction with R.A.E. and the detail design, together with the engineering of Dexan for airborne trials, was undertaken at Stanmore. Flight evaluation, in a M.o.A. Comet IA operating from A. and A.E.E., Boscombe Down, started in December of last year and the first trials were completed in April.

Primarily developed for military applications Dexan is, in effect, two transistorized computers in one. The main part of the computation is undertaken by a device known as a Digital Differential Analyser. Backing up the D.D.A. is a general-purpose computer which makes calculations that the first part of the system cannot undertake. Inputs and outputs to the system are analogue quantities and, where these enter Dexan, conversion is made from analogue to digital representation. Outputs are by counter-type displays visible to the operator and by digital to analogue converters.

This experimental system in effect is an airborne "breadboard," and very little attempt has been made at this stage to package the circuitry in the most compact fashion. But G.E.C. state that they will be able to reduce the most complicated Dexan production unit to a volume of less than one cu. ft. and a weight of under 50 lb.

For the initial airborne trials the computer was set up to undertake continuous navigational computations on information obtained from a Green Satin Marconi Doppler radar, with a Sperry Rotorace gyro acting as a heading reference, and from air data instruments. Outputs from Dexan were employed to provide latitude/longitude information on counters and to drive an R.A.E. Topographical Display Unit. Designed, developed and produced by R.A.E., this last unit presents the computed ground positon and track of the aircraft superimposed on a projected image in colour of a topographical map. The maps are on micro-film which can be driven simultaneously in N-S and E-W co-ordinates.

In addition to the main Dexan units, the Comet installation also comprised a tape reader, for feeding data and programmes to the computer; a tape punch to record the computed information; and a control panel containing airspeed, heading and drift indicators, and manual input selection controls. A Decca receiver, Flight Log and Decometers were employed to enable the Comet to be flown along an accurate flight path and to establish its position at a number of specified "fix points."

In addition to simple navigational problems undertaken in the first trials, Dexan could be used to combine the outputs of several systems such as inertial, automatic astro and new forms of radio navaids. It would also have calculating capacity available for such problems as fuel control and flight optimisation procedures.

The computer is considered adaptable for commercial aircraft use and G.E.C. hopes that in its simplest form Dexan can be available to the airlines in three years and will cost less than £5,000. A more complicated system costing around £20,000 may be ready in about five years.

Aviation News in General

FASTER COMET.—A revaluation of aerodynamic and structural factors of the Comet 4C has resulted in a change in the flight manual to increase the permissible cruising speed. The increase of 0.03 in Mach number is associated with a 20-knot increase in indicated airspeed. The higher speeds can be reached without exceeding recommended engine cruise r.p.m. and the Avon overhaul life is not affected. Comet 4Cs are used by Mexicana, U.A.R. and M.E.A., and five for R.A.F. Transport Command are now on the line at Chester.

INDIAN MISSILES.—The Indian Premier, Mr. Nehru, is reported as saying that "successful experiments" with nationally developed air-to-air guided weapons have recently been completed. He was speaking at the winding up of a parliamentary debate.

TRICKLE BEFORE THE FLOOD.—Maiden flight of the first European-built F-104G Super Starfighter was on Aug. 10. This was the first of 210 from the southern German consortium, known as ARGE Sud, of Messerschmitt, Dornier, Heinkel and Siebel. First flight of an F-104G from the northern group is imminent.

CHOPPERS DESIGNATED.—The Bell Model 206 (project D-250) light observation helicopter recently selected by the U.S. Army for prototype construction has been designated HO-4. The Hiller Model 1100, selected with the Bell design from 12 design proposals, will presumably be the HO-5. The Army has previously evaluated, in trial quantities only, the Sud/Republic Djinn as the YHO-1, the Hughes Model 269 as the YHO-2, and the Brantly B-2 as the YHO-3.

NO HANDS.—Wg. Cdr. Wallis demonstrates the docile handling of his WA 116 single-seat rotorcraft, which is being developed in conjunction with the Miles division of the Beagle Group. (see page 220).

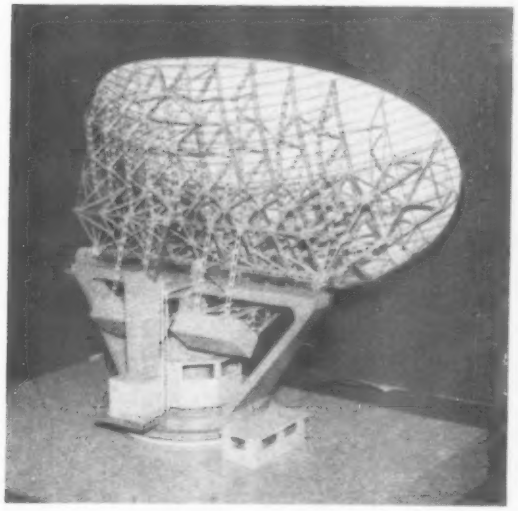
ART IN AVIATION.—We learn that the Society of Aviation Artists is to extend the scope of its activities to include all industrial paintings and will in future be known as the Industrial Painters Group incorporating the Society of Aviation Artists. A meeting of members is to be held on Sept. 1 to decide on a future policy. The annual Guildhall Exhibition, from Sept. 21 to Oct. 7, will be organized in relation to the new title.

BLACKBUSHE SET-BACK.—Hampshire County Planning Committee rejected on Aug. 25 Air Vice-Marshal Donald Bennett's application to re-open part of Blackbushe for light and executive aircraft use. A.V.M. Bennett commented that he was not surprised at this set-back but was confident of the result following his impending appeal to the Ministry of Housing and Local Government.

B.L.E.U. TRIALS.—The D.H. Comet 3B (G-ANLO), which played a significant part in Comet 4 and 4B development, has now been allocated to the Blind Landing Experimental Unit at Bedford. It is flying in full military livery with the serial number XP915.

Farnborough Coverage

First hand impressions of what can be seen at the S.B.A.C. Show will be found in next week's issue. This will be followed by more detailed reports in our Second Show Report, out on Sept. 14. These issues, much enlarged, will cost the usual 1s. 6d.



SPACE LINK.—This working model of an 85-ft. steerable paraboloid antenna is "similar in design" to equipment which the G.P.O. is establishing at Goonhilly Downs on the Lizard, Cornwall, in preparation for experimental trials with American Relay and Rebound communications satellites next year. Tests will include the transmission of speech, telegraphy and television across the Atlantic. The model is to be seen at the Radio Show at Earls Court.

Photograph copyright "The Aeroplane and Astronautics"

BLUE STREAK.—An actual de Havilland Blue Streak rocket, of the type which may serve as the first stage of a European heavy satellite launcher, will be the dominant feature of the outside exhibition area at the S.B.A.C. Show.

SEEKING SPACE DUST.—Another attempt was being made this week at Wallops Island, Virginia, to launch an S-55 "micro-meteoroid" satellite into orbit between 280 and 610 miles from the Earth. Designed to count and measure dust particles in space, the satellite experiments are installed around the fourth stage of the Scout launching vehicle.

Commercial Aviation Affairs

LICENCE APPEAL.—The British Transport Commission has appealed against the A.T.L.B. decision to grant an Air Service Licence to Morton Air Services (B.U.A.) for a Swansea-Birmingham scheduled service. The B.T.C. was the sole objector at the public hearing on May 31. The appeal will be heard at No. 10 Carlton House Terrace, on Sept. 14.

AIRWAY REVISION.—Between Aug. 21 and Nov. 22, inclusive, there will be a trial revision of the eastern boundaries of Airway Amber Two and the London Terminal Control Area. This revision is designed to improve navigational guidance on the airway and to provide airspace for radar manœuvring clear of the Watford stack. Details are given in Civil Aviation Information Circular No. 74.

CAMBRIAN NEWS.—Work started early this week on a £50,000 maintenance, engineering and administrative headquarters for Cambrian Airways at Cardiff (Rhoose) Airport. The company's registered office is now at the airport (telephone Rhoose 331) and Mr. L. G. Roberts has succeeded Mr. W. W. Stanley as company secretary.

AFRICAN FRIENDSHIPS.—A contract for three Fokker F-27s was concluded by East African Airways last week, with an option on a further quantity. Interest in the Friendship has been reported by Nigeria Airways, and a contract may be signed soon.

SCAT FOR BOEING.—The Safe Flight Instrument Corporation's speed condition - approach / take - off system (SCAT) is to be installed in a Boeing 720 for evaluation. SCAT combines the Safe Flight lift signal (derived from the stall warning indicator) with horizontal acceleration data to give pilot information during take-off and landing.

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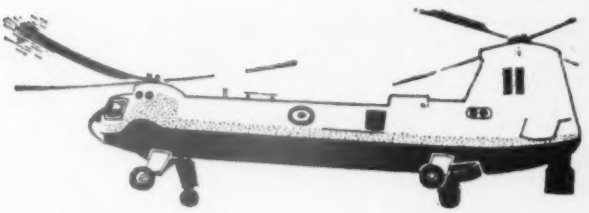

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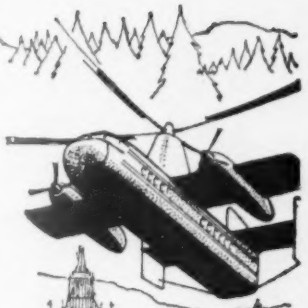

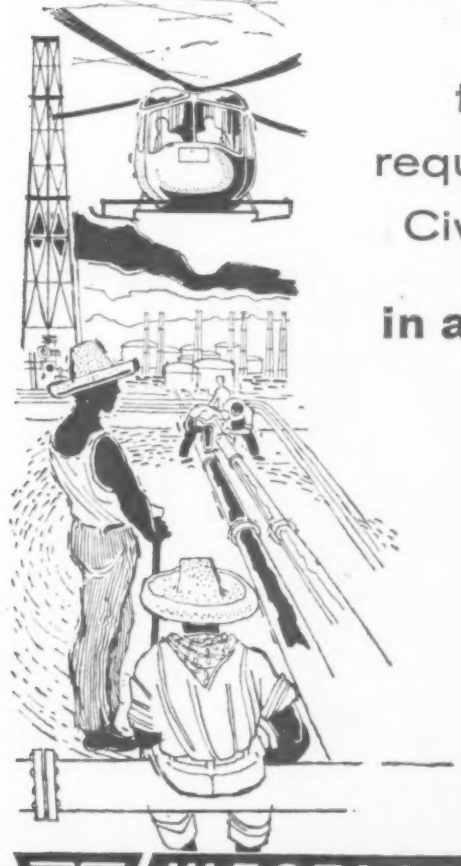

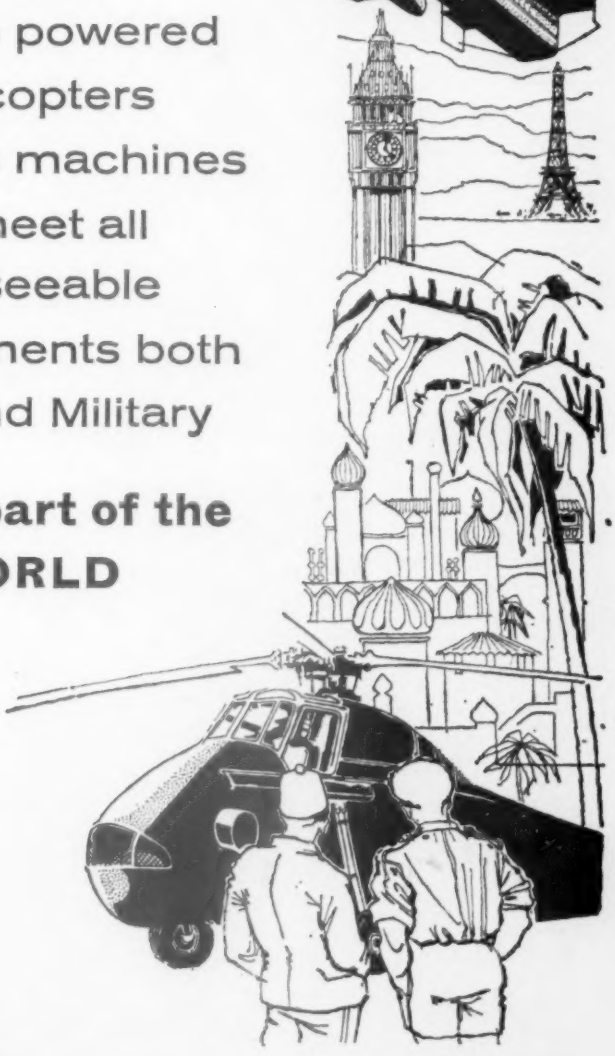

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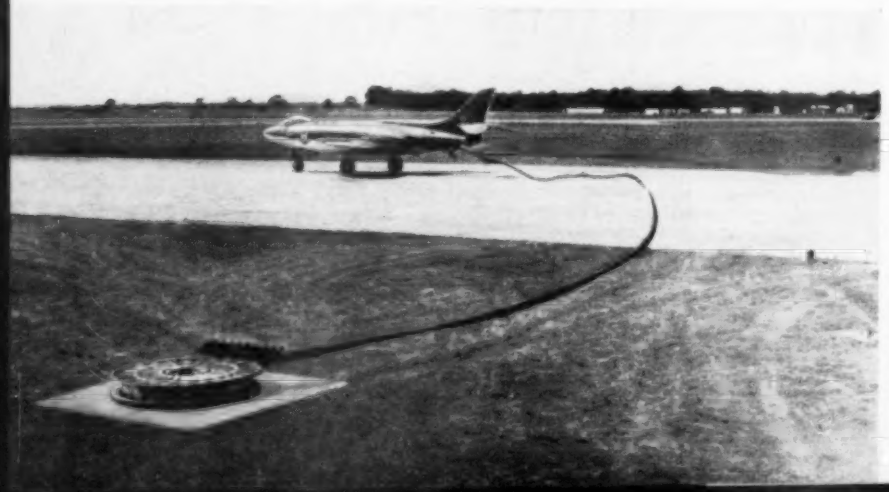

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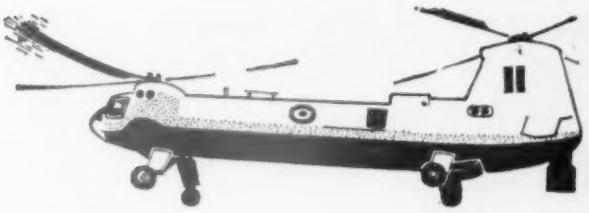

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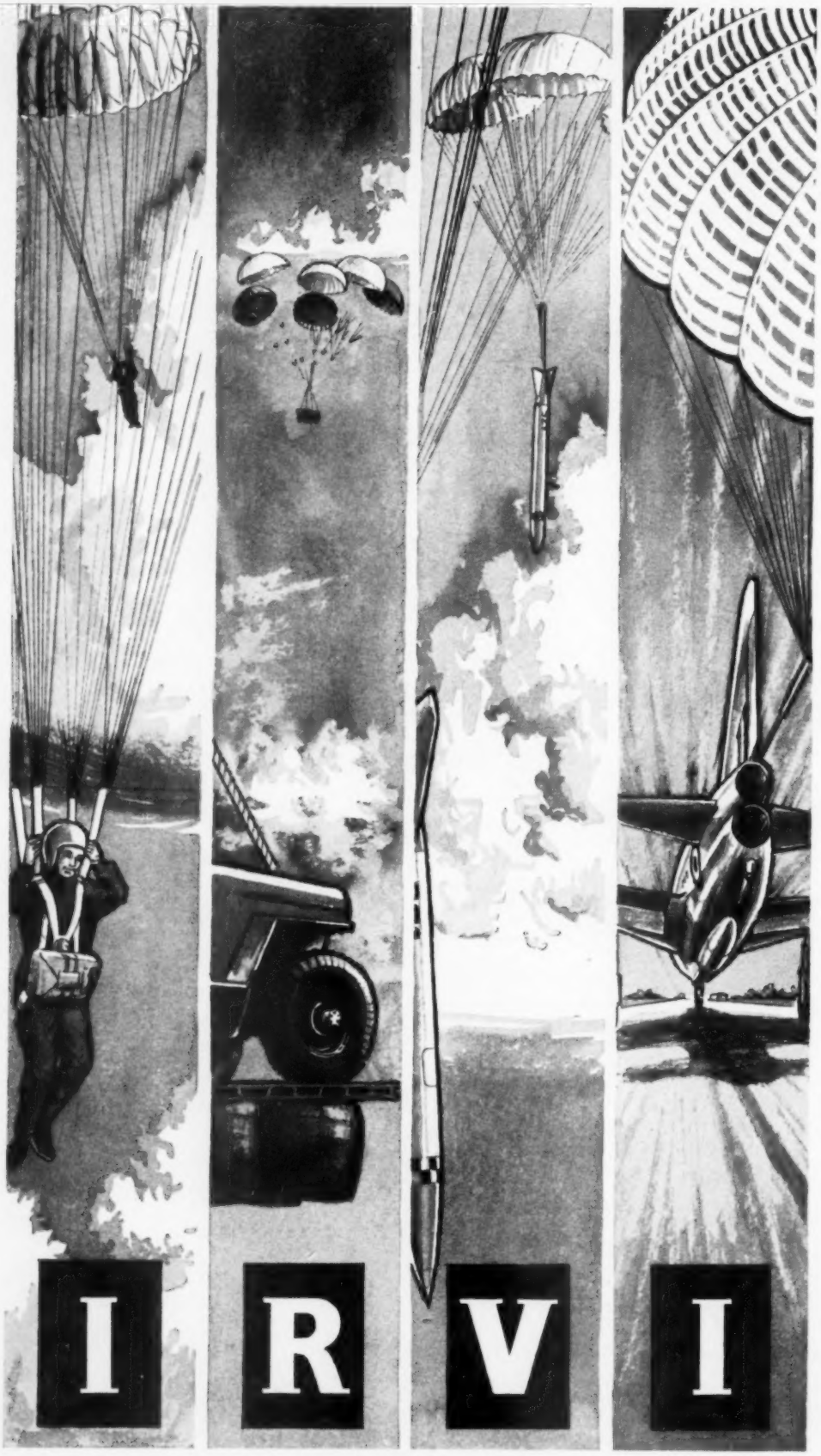

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Air Transport

The First Appeal

TWO days were required last week for the public hearing of an appeal by Falcon Airways against an Air Transport Licensing Board decision. It was the first such appeal, and was heard by Sir Leonard Stone, appointed as Commissioner by the Ministry of Aviation. His report to the Minister will be public and, under statutory regulations, reasons must be given for the Commissioner's recommendation. If the Minister does not accept the recommendations, in whole or in part, his reasons must also be published.

The right of appeal from A.T.L.B. decisions has been one of the most criticized features of the Civil Aviation (Licensing) Act, 1960, and the first example of the process in action has done little to quell the fears that it is ill-founded. The Commissioner's brief requires that he listens to substantially the same evidence that has already been presented to the A.T.L.B. He is then expected—as a single individual—to confirm or dissent from the conclusions reached by a nine-man Board which has no opportunity to reply with the detailed reasons for its initial decisions.

It might be argued that, if a Commissioner is thus considered to be able to reach a right decision when the Board may not, the Board is redundant and all decisions could be heard by a Commissioner in the first place. If a right of appeal is essential to the regulation of air services, then the Commissioner should at best have only the power to refer a decision back to the Board, indicating his reasons for dissenting from it.

If the operators so wished, they could make a nonsense of the entire A.T.L.B. procedure by appealing against every decision. Already two more appeals are down to be heard later this month—one from the British Transport Commission over a licence for Morton Air Services to operate between Swansea and Birmingham, and that from B.O.A.C. in respect of the Cunard-Eagle North Atlantic licence.

Air Ceylon Retracts

CEYLON has decided to suspend its international air services from Nov. 1, and to concentrate in future on domestic and regional services. The decision has been reached by a Cabinet sub-committee and is in accord with the recommendations of Air Ceylon itself. Mr. W. A. E. Molamure, general manager of the airline, said recently that the ideal, in his view, would be to concentrate upon regional development, up to a range of about 2,000 miles, with the purchase of new equipment for these routes.

Mr. Molamure also said that Air Ceylon should not be expected to show a profit. It would be foolish, he said, to think that any investment by the Government of Ceylon could get a good return. An airline should be treated as a public utility and Government assistance was necessary if it was to continue to exist. Mr. Molamure said: "There is no point in painting a rosy picture. When we go before the Cabinet sub-committee . . . we are going to give them straight facts."

Air Ceylon is said to have had a revenue of Rs. 1 million from the K.L.M.-operated international services to Europe and Singapore. K.L.M. said recently (see our issue for Jly. 27) that the partnership could be continued only if Ceylon contributed a greater share of the costs. The problem has been complicated by K.L.M.'s decision to introduce DC-8s in place of Electras on its Far East services; neither of Ceylon's two civil airports, at Ratmalana and Katunayake, are large enough for the big jets, and planned extensions to the runway at Katunayake will not be complete for two years.

The possibility that Air Ceylon might conclude an agreement with another airline to operate international services has not been ruled out, and discussions with both Air India and B.O.A.C. have been rumoured. B.O.A.C.'s Comets are at present the only jet aircraft serving Ceylon.

Supersonic DC-8

A DOUGLAS DC-8 Series 40, powered by Rolls-Royce Conway engines, reached supersonic speed in the course of a flight from Long Beach to Edwards Air Force Base on Aug. 21. Observed and calculated Mach numbers from 1.005 to 1.01 were recorded at 40,350 ft., representing a true air speed of 579 knots (667 m.p.h.). The aircraft was in a dive when these speeds were achieved. Askania tracking cameras on the ground were used to verify, by triangulation measurements, the normal and test instrumentation in the aircraft.

Douglas also claim a load-to-altitude record for jet transports on the same flight. The DC-8 is reported to have reached 52,000 ft. at a weight of 171,000 lb., of which 37,000 lb. was "useful load."

EUROPEAN DEBUT.—Swissair's two Convair 880-Ms have now been delivered for service pending the introduction of the 990 Coronados next year. Since Aug. 16, they have been operating some London-Zurich services, and they will go on to the Zurich-Tokyo routes on Sept. 15. The pictures below show the first 880-M at London Airport.

Photographs copyright "The Aeroplane and Astronautics"

Air Transport . . . .

B.E.A. Past and Future

BRITISH EUROPEAN AIRWAYS' annual report (reviewed in our previous issue)—and the remarks of the chairman and the chief executive at the Press conference which introduces it—normally provide an opportunity to assess the Corporation's progress, plans and problems. This year, the report strikes a sombre note, with its warnings of difficult times ahead.

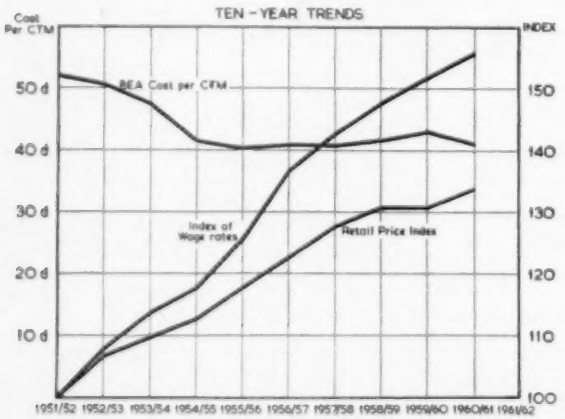
The traffic recession in the current financial year is causing much concern and although seven consecutive profitable years have allowed B.E.A. to acquire sufficient financial strength to survive a temporary set-back, it is already clear that the Corporation will not be able to remain in the black in 1961-62 without a considerable struggle. In the first four months of the current year (April to July), B.E.A. traffic has increased by 14%, compared with a 21% increase in capacity. The revenue, in these four months, fell short of expectation by £1,700,000; there were, however, savings in expenditure of £450,000, so the net adverse variation on budget is £1,250,000. These four months, and the three which follow, make up the summer season, in which B.E.A.'s profit is normally made.

Some, at least, of the reasons for the shortfall in expected traffic this year are clear—the trade recession in Europe, and the reluctance of Americans to travel in the light of the international situation and recent warnings about the U.S. balance of payments. The "missing" passengers are almost entirely those who normally buy their B.E.A. tickets in the U.S.A. or whose journeys originate outside the U.K.

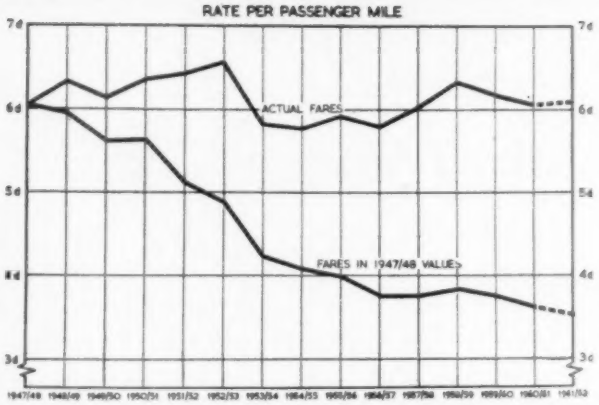
A further problem for B.E.A. is, as we noted last week, the increase in Government charges and taxes, including an increase in interest rates payable to the Treasury which will cost £40,000 this year and £180,000 in a full year. Of the proposals in the recent White Paper on "Civil Aerodromes and Air Navigational Services," Lord Douglas said that the airlines should not be expected to pay the full cost of technical services and A.T.C. provided by the Ministry. This would be out of line with the practice of other Governments, and the main burden of such a charge would fall on British airlines, as the largest users of the service. The suggestion that a passenger service charge be imposed on domestic passengers is also criticized; even if this were only 5s., it would represent an 8% increase on the proposed £3 3s. one-way fare on the Scottish trunk routes next winter.

These are all matters to which B.E.A. rightly draws attention and which, clearly enough, are likely to influence the 1961-62 results. Nearly two pages of the Report are also devoted to the subject of the independents' applications for parallel route rights with B.E.A., and here the Corporation seems to overstate its case. It was unfortunate, perhaps, that the Report had to appear when the outcome of the A.T.L.B.'s epic Public Hearing No. 21 was still unknown. Within a matter of weeks much of the uncertainty about the future, which B.E.A. stresses, will have been resolved and, although it must be anticipated that the A.T.L.B.'s decision may hurt the Corporation, references to possible diversion of revenue of over £7 million in a year and expressed doubts about the need for all 24 Tridents now on order, are hardly realistic. "B.E.A." as a *Times* leader said last week, "is crying before it is hurt."

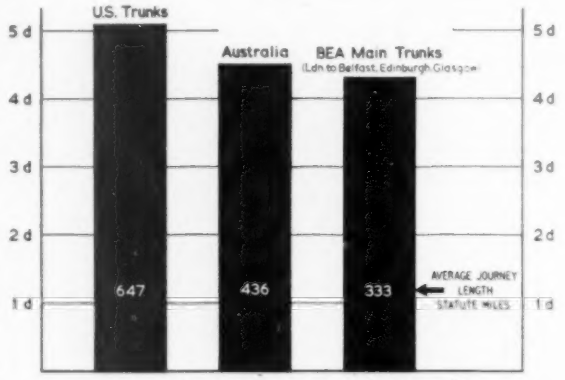
Among other points to come out of the Press conference were that B.E.A. expects to gain £400,000 in revenue this year from the forthcoming 5% increase in European fares, and £2 million in a full year. Vanguard development costs were described as "enormous," perhaps as much as £2 million; late deliveries meant that the teething problems were encountered during the summer peak, and the engine overhaul life was still at 400 hours instead of 1,200 as it should be by now. This, in turn, meant that there was an engine shortage and, in any case, only 10 of the 20 Vanguards had been delivered. Utilization this year would be about 800 hours; the target was 2,000 hours next year. A modification programme was in hand to reduce vibration and to cure a tendency to yaw in some conditions. The sum recovered from Vickers because of the late deliveries was "less than £500,000."



B.E.A. cost per C.T.M. and U.K. prices and wage rates.



B.E.A. fares 1947/48 to 1960/61. Broken lines show estimated rates for 1961/62, including winter increases in international fares.



Average domestic fares per passenger mile.

In 1960-61 B.E.A. carried about 300,000 inclusive tour passengers at an average one-way fare of just over £10 each. Britain's entry into the Common Market should help B.E.A., especially with freight traffic, and this in turn would probably mean an order for more Argosies. The Corporation has been short of capacity this year, but it is hoped that all chartering of freight aircraft (accounting for about 10% of freight capacity this year) will end by Nov. 1.

The no-reservation air-bus service is still "a goal towards which we [B.E.A.] are working"; the problem is to provide adequate capacity without wasting stand-by aircraft and crews. It is intended to run such a service on a suitable domestic route next spring on a trial basis.

Big Brother F.A.A.

A NEWS release from the Federal Aviation Agency on Aug. 17 gives a salutary reminder of the powers of this government agency to exact penalties for violation of Civil Air Regulations. The maximum penalty of $1,000 (over £350) is being sought by the Agency from a Los Angeles citizen, who is accused of becoming intoxicated (from his own bottle of liquor) on a South Pacific Air Lines flight between Tahiti and Honolulu on Mar. 4, 1961. He then, says the F.A.A., "allegedly harassed and assaulted passengers and crew members, endangering their safety and disrupting the flight by threatening to take over the aircraft."

The exacting of this particular fine apparently depends on the outcome of a civil suit in the Los Angeles courts. It may not be widely known, however, that the F.A.A. regularly assesses fines for violations of C.A.R.s within the airline industry. Reference to some recent examples of F.A.A. action in this respect is made in the August issue of *Airlift*. They include the withdrawal of an air transport rating and medical certificate from a pilot for "demonstrated lack of responsibility" and "disregard for morals and the ordinarily accepted

(*Continued on page 227*)

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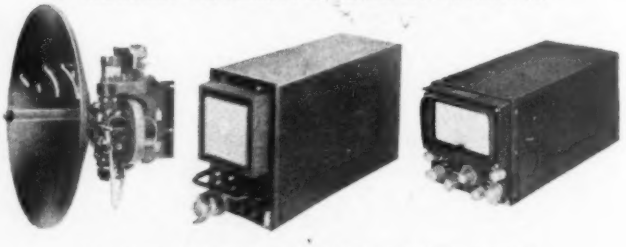

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Air Transport . . . .

standards of human decency." (He is alleged to have served two prison sentences for uttering forged cheques, been married twice bigamously, and been employed and discharged by eight companies.)

For what are described as maintenance violations, National Airlines, American Airlines and T.W.A. recently paid a total of $11,900 in fines. Examples of F.A.A. action against individuals were a fine of $200 on a Southern Airways' captain who cancelled his IFR flight plan during an ILS approach in weather below his minima; a $250 fine on Northeast Airlines for a Viscount flight which aborted because of in-flight vibration caused by a bent inspection plate with nine of its 11 screws missing; and a fine of $100 on the captain of an aircraft damaged in an apron accident because the nose-gear control was actuated instead of the flap control lever.

Footnote: The F.A.A. is proposing an amendment to C.A.R.s which will make airlines responsible for preventing intoxicated persons from boarding transport aircraft. At present, the captain is responsible.

News About Aeroflot

THE July issue of *Grazhdanskaya Aviatsiya* (*Civil Aviation*) —the monthly journal of Aeroflot—contains some further information given at General-Colonel Loginov's Press conference at Moscow/Vnukovo earlier this year.

The Tu-124's take-off run was, for instance, given as 800 metres (2,625 ft.) and the landing run as 1,500 metres (4,920 ft.) as the maximum. There are three variants of accommodation: first class with 43 seats; tourist with 55-60 seats; and "economy class" with 68 seats. It is intended that this short-haul twin jet should be used on domestic services and on the Moscow-Berlin, Moscow-Vienna and Moscow-Bucharest routes.

The An-14 "Pchelka" light twin has a take-off run of 50-60 metres (165-197 ft.) and a landing run of 40-50 metres (130-165 ft.). The An-24, it was stated, is fitted with two Ivchenko AI 24 turboprops.

Some figures for the Tu-104 given in the article are: max. speed at 10,000 metres (32,800 ft.), 1,000 k.p.h. (625 m.p.h.); useful load, 12 tons; span, 34.54 metres (113.32 ft.); length, 40.06 metres (131.365 ft.); range "about" 4,000 km. (2,500 miles).

Similar figures for the Il-18 are: speed at 8,000 metres (26,245 ft.), 650 k.p.h. (404 m.p.h.); span, 37.4 metres (122.70 ft.); length, 35.9 metres (112.8 ft.); take-off weight, 61 tons.

The Alma-Ata servicing workshops intend to get at least 2,600 hours flying out of every Il-14 in 1961 (in 1960 the average figure was 2,386 hours and the official planned figure for 1961 is only 2,100 hours). Two 100-hour inspections of Il-14s are done at these workshops every day and this includes an engine change in one of them.

In 1960 the Polar Aviation division Il-18 proving flights on the Moscow-Norilsk-Tiksi-Anadyr route were successfully completed and An-10s made their first ice-floe landings. Extensive programmes to supply Arctic and Antarctic expeditions were also operated. [As noted in a recent issue, An-10s are now operating in the Arctic on skis.]

General Loginov attached particular importance to the development of helicopter routes in the mountainous regions of the country and where airfields cannot be sited—especially the mountains of the Caucasus, of the Archangel and Murmansk oblasts, of the Northern Komi A.S.S.R. and of the Far East and Krasnodar Kraj. Other important regions for helicopter operations are the south shore of the Crimean Peninsula, the Caucasus coast, Azerbaidjan and in the Moscow area—connecting the old central airport (Moscow/Khodinka) with the main airline terminals.

The passenger version of the Mi-6 is due to be tested during the last quarter of this year.

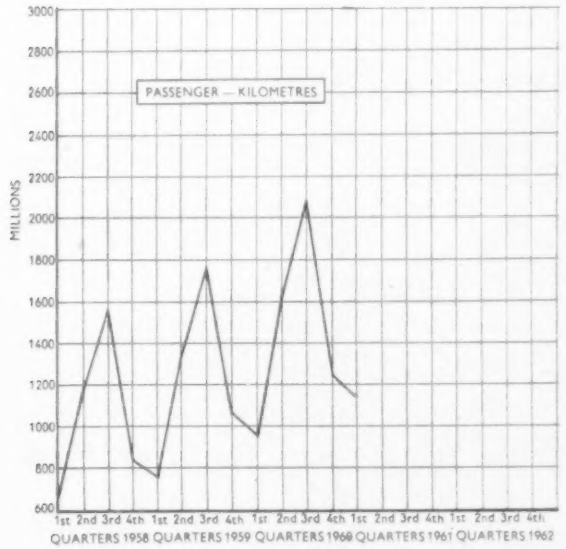
European Traffic Trends

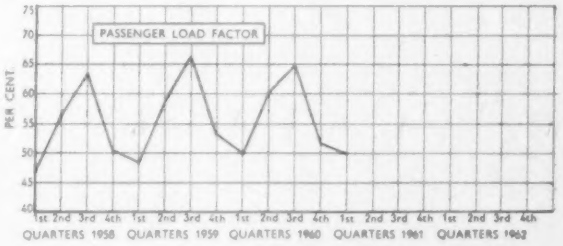
AIR RESEARCH BUREAU figures for intra-European international traffic in the first quarter of this year show that a fairly healthy rate of growth of passenger traffic was maintained at 20%. This coincided precisely with the airlines' budgeted increase in capacity, to hold the load factor steady at 50%. Figures for the second quarter, when they become available, are likely to appear less favourable, with a decline in European travel inevitably associated with the recession in North Atlantic travel (see last week's issue).

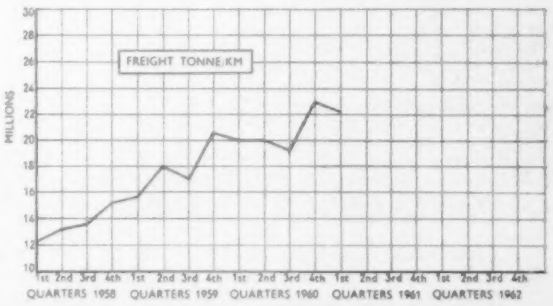
In the first quarter, approximately one in three of all European passengers was carried in a jet aircraft. The average aircraft capacity increased from 55 to 62, the average passenger load from 27 to 31 and the average passenger stage length from 345 miles to 363 miles. Tabulated results are on the right.

	1st Quarter		1961 as % of 1960	12 mths. ending		1961 as % of 1960
	1960	1961		March 1960	March 1961	
Seat/km. (million)	1915.7	2297.2	120	8853.3	10674.5	121
Pass/km. (million)	954.5	1149.5	120	5138.7	6130.4	119
Pass. load factor %	49.8	50.0	—	58.0	57.4	—
Freight tonne/km. (million)	20.4	22.2	109	77.0	86.1	112
Mail tonne/km. (million)	4.4	4.8	109	17.5	18.6	107

Intra-European traffic includes all traffic carried on international routes originating and terminating within the European continent and countries bordering the Mediterranean. Airlines included in this survey are: Aer Lingus, Air France, Alitalia, B.E.A., B.O.A.C., Finnair, Iberia, Icelandair, KLM, SAS, Sabena and Swissair.







The Anglo-European Air Freight Potential

TWO months or so ago a speaker on air freight at the I.A.S./A.R.S. joint meeting in Los Angeles said, among other things, that "co-operative fact-finding and research will provide the basis for reasonable decisions" in meeting the "challenge of creating an air-cargo industry."

Just such a co-operative effort has produced a study of U.K.-European air freight prospects which became available on Aug. 16. This—"Air Freight and Anglo-European Trade"—has been produced by Dr. Kenneth R. Sealy and Mr. Peter C. L. Herdson, of the London School of Economics and Political Science, with the collaboration of Mr. A. H. Stratford and Mr. J. F. R. Brown of the A.T.S. Company (Hawker Siddeley), acting for Sir W. G. Armstrong Whitworth Aircraft. The principal conclusions of the study are summarized on the right.

The purpose of the survey was that of acquainting aircraft manufacturers and the air transport industry of the present competitive position of air freight by examining relative distribution costs of British exports to Europe. In "sampling," the total distribution costs of more than 5,000 representative consignments were studied and distribution times were also assessed. As the basis for the work it was assumed that total distribution costs are more relevant than simple freight charges and the study was planned accordingly.

The information obtained from this survey permitted the study of two important aspects of air freight policy—rates and equipment. The comparative cost analysis permitted the estimation of potential traffic at lower freight rates. These, in turn, were related to the costs of air freight operations in Europe, both with existing equipment and with specialized freighter aircraft.

The study is in three main parts: the first is a general appraisal of U.K. air freight; the second investigates the export traffic to Europe in machinery, with a small sample from textiles; the third examines the relationship between freighter costs and revenue, for two operational cases, at levels of traffic typical of those of today and at forecast potential levels.

An example of the kind of information obtained is that a sample analysis of B.E.A. waybills for November, 1959, showed that about 80% of the consignments were of 45 kg. or less in weight and these consignments accounted for about 20% of the total weight and provided about 30% of the revenue. At the other end of the scale, consignments of 500 kg. or more accounted for 2% of the total number, 37% of the total weight and 27% of the revenue.

In studying the export traffic in machinery and textiles it was found that the average density of consignments was 22.9 lb./cu. ft. while 83% of them had a bearing weight of less than 100 lb./sq. ft.—which is well within the floor-strength capacity of most modern aircraft. Door size appeared to be critical in about 20% of the cases. Of the 151 type consignments considered in machinery there were five cases where air rates, as such, were favourable, but 23 cases where total distribution costs favoured air transport.

Distribution-time analysis showed that up to 80% of the total is spent in "static" functions like loading, packing and Customs clearance.

A breakdown of air distribution costs showed that transport costs to and from airports could be an important item—reaching 10-15% of the total costs where companies in the Midlands and North were sending shipments through London Heathrow.

A typical specialized freighter, the study considers, could carry 100% more traffic at only 18% greater cost, thus yielding a possible 40% increase on present profit levels. Its lower unit costs would become effective when the traffic had expanded by rates less than 20% above the present level, irrespective of whether the new traffic was generated by rate reductions or not.

PRINCIPAL CONCLUSIONS

British trade with Europe is second only to that with the sterling area, but the contribution which air freight makes in carrying this trade is small. Most Anglo-European air freight is carried less than 500 miles, the air freight share of the traffic being greatest to the nearer countries.

The most important destinations are in the main countries of the Common Market—France, Germany and Italy; the most important groups of commodities are machinery and textiles. The potential for the expansion of air freight is considerable; the relative levels of distribution costs, quality of service and aircraft operational costs will be important in future development.

* * *

Total distribution costs provide a better yardstick than freight costs alone for measuring the economic advantage of air freight. Only 2% of consignments studied were cheaper by air when assessed on freight charges, but 18% were cheaper when assessed on total costs.

There are, however, difficulties in assessing total distribution costs accurately, particularly when the manufacturer, agent and consignee are all concerned with the choice of transport and the cost is shared between them. The consignee may pay for the transport but the manufacturer may cover the cost of packing; the latter frequently does not assess packing costs accurately and may regard them as part of production rather than distribution. The large proportion of consignments shipped f.o.b. suggests that transport arrangements frequently cannot be altered without the consignee's permission.

* * *

However, even in total cost terms, air freight is cheaper in only 18% of cases, and the dominant cost element is the freight charge. Overall reductions in air rates of 40% and 50% could lead to increases in traffic of 120% and 220% respectively. These reductions could also extend the competition radius of air freight, in cost terms, from the current limit of 250 miles from the U.K. to cover the whole of industrial Europe.

Specifically, rate reductions are recommended for the larger consignments—over 500 kg.—for which air freight generally offers the greatest reduction in "other" costs. Rate reductions in this weight group would also give shipping agents advantages in consolidation for air freight, comparable with those in surface transport. To compete more successfully over the longer distances, more "taper" in air rates might well be made. Furthermore, air rates should be assessed with some degree of relation to the value of the goods.

* * *

Speed is still an important advantage of air freight. Time spent in distribution is important both in cost and in sales advantage in overseas markets. "Static" time in air distribution is far too high a proportion of the total, and seriously impairs the basic advantage of speed in air transport.

More direct services from the Midlands and North to the Continent will become essential as traffic expands. Streamlining of Customs procedures and the "through unit" concept of palletized freight handling would make substantial improvements whether Britain joins the Common Market or retains the E.F.T.A. alignment.

* * *

There is an actual and potential loss to air freight of consignments too large to fit into the holds of existing freight aircraft. A more serious disadvantage in the development of air freight is that operators of these freight aircraft will probably not be able to take advantage of the higher traffic potential at lower rates, in view of their low capacity and high unit operating costs.

The specialized cargo aircraft—principally because of its higher capacity and lower unit costs—could provide a superior air freight service, offering higher airline profit margins and generating more traffic at lower freight charges.

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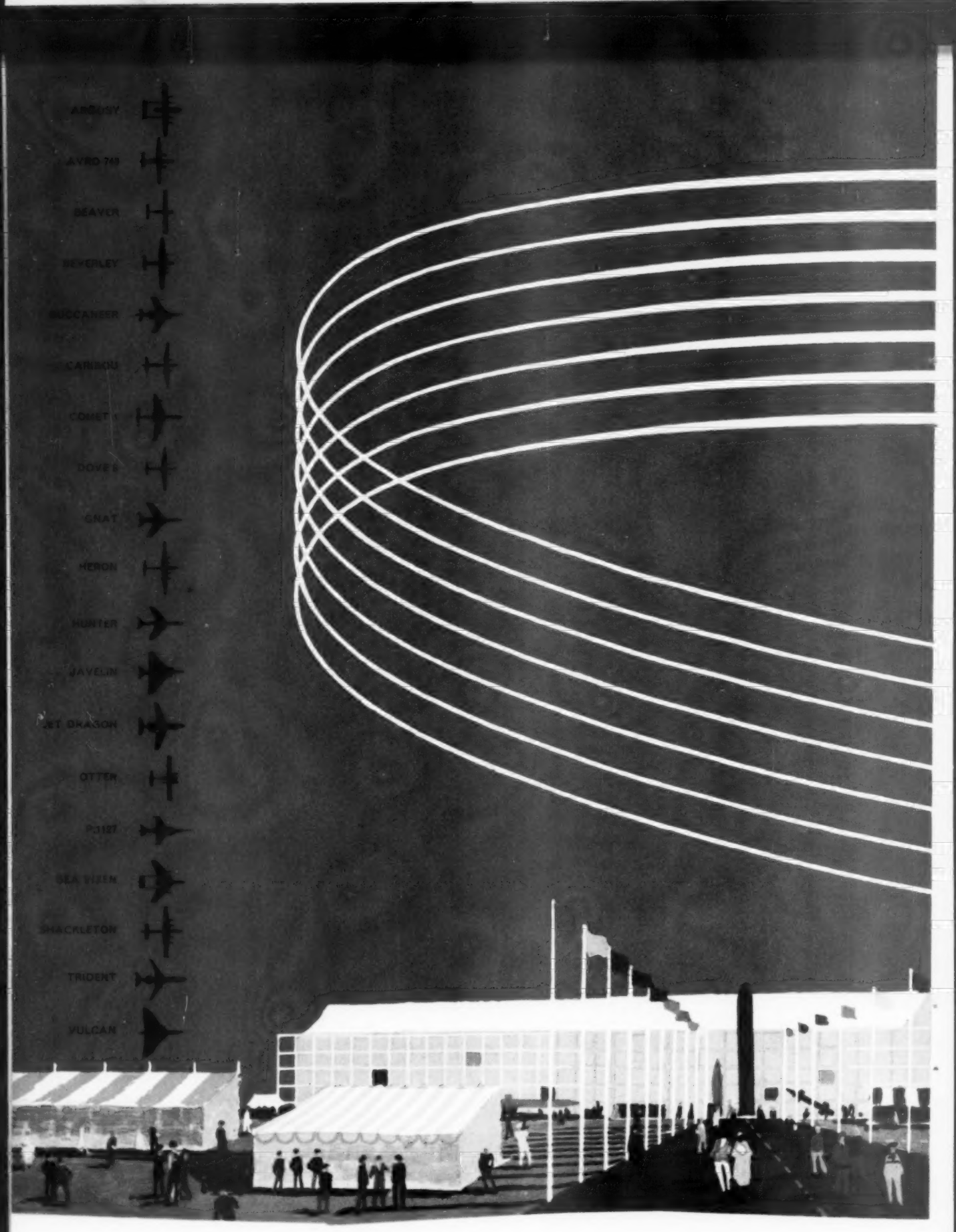

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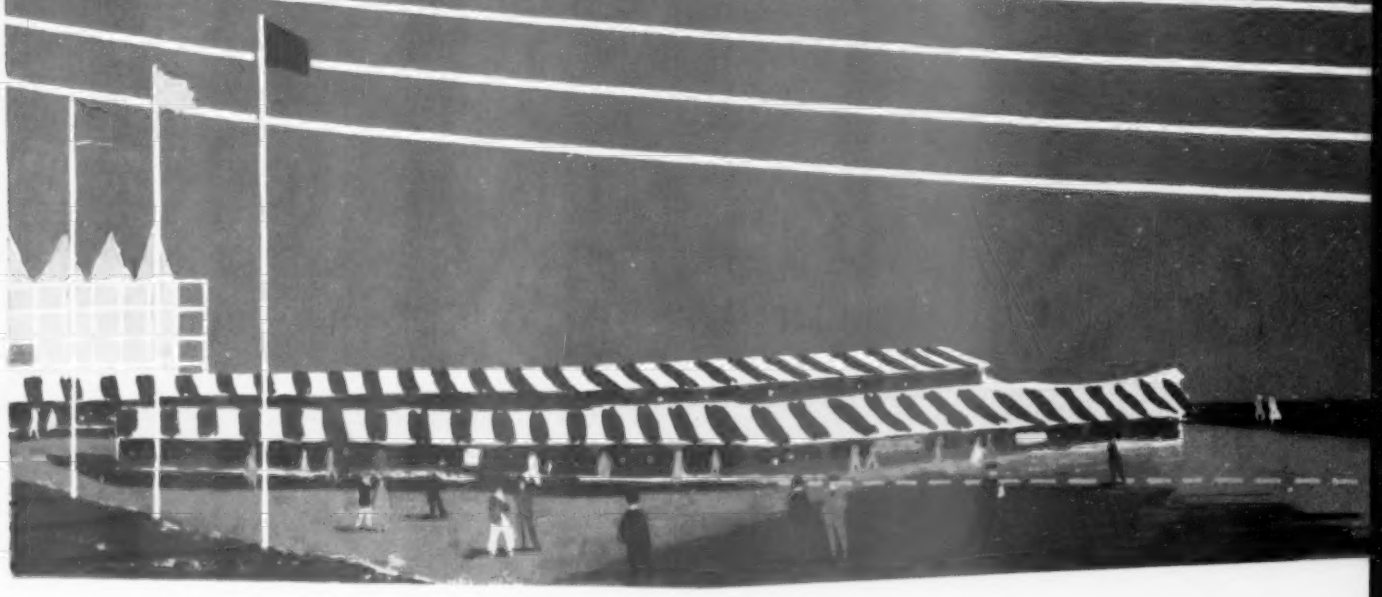

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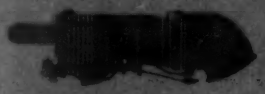

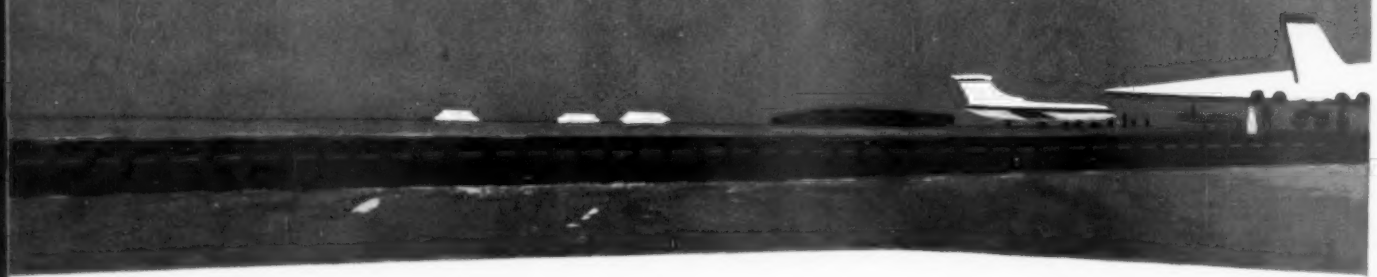

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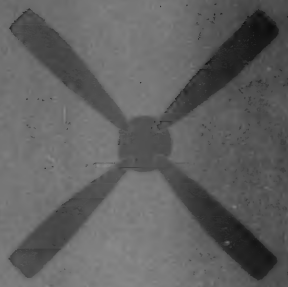

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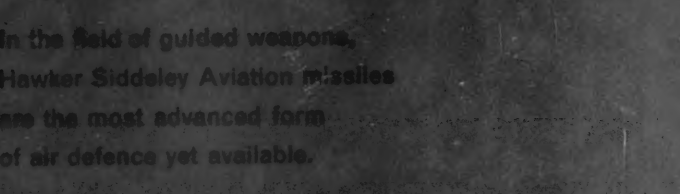

HAWKER SIDDELEY AVIATION

In parallel with aircraft, engine and missile development, Hawker Siddeley Aviation manufacture:

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Airborne digital computers

Aircraft flight simulators

Air conditioning systems

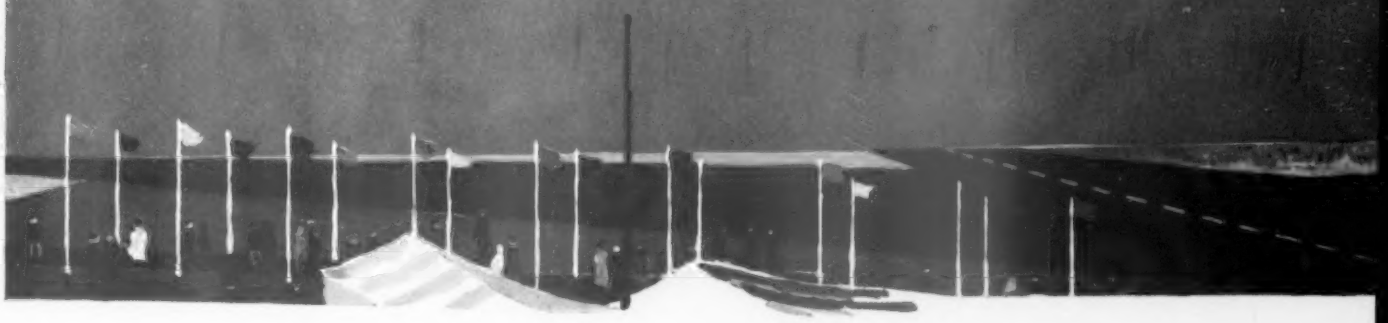
Aircraft fuel systems

Hydraulic control systems

Master dynamic reference systems for high-speed aircraft

Ejector seats

Airborne freighting equipment



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TAC 196

The Fighting Services

The Navy at Farnborough

THE Fleet Air Arm's participation at the Farnborough S.B.A.C. Show next week will feature Scimitar F.1s of Nos. 800 and 804 Squadrons, Sea Vixen FAW.1s of Nos. 890 and 899 Squadrons and Gannet AEW.3s of No. 849C Flight operating from Farnborough, H.M.S. "Hermes" and R.N.A.S. Yeovilton.

At the start of the overall flying display, a photographic reconnaissance Scimitar will take off to photograph the President's tent and other features on the airfield. Before landing 30 minutes later, the aircraft will take low-level shots of the carrier "Hermes," and these photographs will be exhibited at the show before the flying programme is concluded.

A Scimitar and a Sea Vixen will give a demonstration of toss-bombing. This will be followed by a buddy in-flight refuelling demonstration by a pair of Scimitars or a pair of Sea Vixens. Nine Scimitars of No. 800 Squadron will then give a display of formation aerobatics lasting nine minutes and followed by a stream landing. Finally, 10 Sea Vixens, five Scimitars and four Gannets from H.M.S. "Hermes" will stage a formation fly-past.

V-Bombers to Canada

THREE Bomber Command Victor B.1s are to give displays at the Canadian International Air Show to be held at Toronto on Sept. 1 and 2. Drawn from No. 55 Squadron (Wg. Cdr. R. G. Wilson, D.F.C., A.F.C.) at R.A.F. Honington, they were to fly to Malton Airport, Toronto, last Sunday by way of the R.C.A.F. base at Goose Bay, Labrador, where they planned to stay overnight.

Each Victor is carrying its normal crew of five and a crew chief, making, with the ground crews, a total of 34 officers and men. The force is commanded by Wg. Cdr. Wilson and its support aircraft carrying the ground crew is a Transport Command Britannia from Lyneham.

Disbanded in Greece in 1945, No. 55 Squadron was re-formed with Victors in September of last year.

Pakistan Visitor

TOMORROW the Chief of Staff and C.-in-C. of the Pakistan Air Force, Air Marshal M. Asgar Khan, is to start a week's visit to the R.A.F. He will go to Headquarters, Fighter Command, on Sept. 4, visit one of the Command's stations to see Lightnings and Javelins, and inspect a Bloodhound unit. After visiting the Farnborough air display the following day, he will spend two days with the R.A.F. in Germany.

On his return to the United Kingdom Air Marshal Khan will go to Lyneham to see Transport Command Comets and Britannias and to watch Service passenger-handling methods. On Sept. 8 he will call on Headquarters, Flying Training Command, and will conclude his tour with a visit to No. 2 F.T.S. at Syerston.

Vintage Aircraft Work

HAVING just completed, for the National Science Museum, South Kensington, the complete overhaul of a liquid-rocket powered Messerschmitt Me.163 Komet, fitter apprentices at No. 1 School of Technical Training, Halton, have now taken delivery of another interesting vintage aircraft from the Museum for renovation and return.

It is a Cierva C.30A Autogiro, which, at the outbreak of the 1939-45 War, was civilian-operated but, with others, was pressed into service to supplement the R.A.F.'s fleet of Rotas, as the Service version was named. It was subsequently employed at R.A.F. Duxford, together with a number of other Autogiros, on radar-calibration work with No. 1448 Flight, formed in 1940 and first commanded by Sqn. Ldr. R. A. C. Brie, formerly Cierva's chief test pilot. In June, 1943, the Flight was re-formed at Halton as No. 529 Squadron under Sqn. Ldr. H. A. Marsh. It was disbanded in October, 1945.

For radar-calibration work the Rotas operated as independent units with a pilot, engine-fitter and rigger, moving around the coastal radar stations and flying out to sea to send back signals to be picked up by those stations. Arriving at pre-arranged points, the Rota dropped a sea-marker and orbited it at a known height.

SQUADRON STANDARD.—Earlier this month H.M. The Queen presented a Standard to No. 120 Squadron (Wg. Cdr. H. M. Carson) at R.A.F. Kinloss. Owing to heavy rain the ceremony was held in one of the station hangars.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Sqn. Ldr. S. H. Troughton-Smith, with the acting rank of Wg. Cdr., to the Department of the Air Member for Supply and Organization.

Fighter Command: Wg. Cdr. P. A. C. McDermott, D.F.C., D.F.M., to R.A.F. Bovingdon to command; Sqn. Ldr. R. E. Bracher, to R.A.F. Leconfield as Senior Technical Officer, with the acting rank of Wg. Cdr.

Coastal Command: Wg. Cdr. G. H. Wherry, O.B.E., D.F.C., to Headquarters as Senior Personnel Staff Officer.

Transport Command: Wg. Cdr. W. J. L. Harries, O.B.E., M.B., B.S., F.R.C.S., L.R.C.P., to R.A.F. Hospital, Wroughton, as Surgical Specialist.

Flying Training Command: Gp. Capt. G. F. Reid, D.F.C., to R.A.F. College, Cranwell, as Group Captain Executive and Unit Commander.

Technical Training Command: Gp. Capt. D. W. I. Thomas, M.R.C.S., L.R.C.P., to Headquarters No. 22 Group, as Senior Medical Officer.

Maintenance Command: Wg. Cdr. O. E. Bartlett, M.B.E., to No. 94 Maintenance Unit, to command; Sqn. Ldr. T. Cross, to R.A.F. Unit, Ministry of Aviation, Farnborough, for technical duties, with the acting rank of Wg. Cdr.

Royal Air Force Germany: Wg. Cdr. J. R. Musgrave, D.S.O., to Headquarters, for Air Staff duties; Wg. Cdr. C. W. Coulthard, A.F.C., to R.A.F. Gutersloh, to command.

Near East Air Force (Cyprus): Wg. Cdr. F. H. D. Hutter, M.B., B.S., F.R.C.S., L.R.C.P., to R.A.F. Hospital, Akrotiri, as Surgical Specialist.

Air Forces Middle East (Aden): Gp. Capt. E. B. Harvey, M.R.C.S., L.R.C.P., D.T.M. and H., to Headquarters as Principal Medical Officer.

Far East Air Force: Gp. Capt. D. Iveson, D.S.O., D.F.C., to Headquarters for Air Staff duties.

Other Appointments: Wg. Cdr. P. C. A. Rich, to Allied Air Forces, Central Europe, for Plans and Policy duties; Wg. Cdr. A. Brown, D.F.C., to N.A.T.O., Standing Group, Washington, for Planning Staff duties; Wg. Cdr. B. Armiger, O.B.E., to the United States Air War College, as student.

CUTTING EDGE.—At a recent R.A.A.F. display at Canberra this C.A.F.-built Sabre was shown with its various armaments. These include two 30-mm. Aden guns, 24 air-to-ground missiles, two Sidewinder AAMs, two 500-lb. HE bombs and various other smaller external stores.

Mercury Atlas-4

AS we closed for press, preparations were advanced at Cape Canaveral for the second attempt to launch an unmanned Mercury capsule into orbit. It was expected to make one circuit of the Earth before being recovered some 200 miles east of Bermuda.

The first such attempt was made on Apr. 25, 1961, when the range safety officer was compelled to destroy the Atlas launching vehicle when it failed to follow its programmed course after lift-off. The launching was, in fact, terminated after only about 40 seconds, but the MA-3 capsule itself made a successful separation and was subsequently recovered "in good condition" after parachuting down into the sea. Just how good this recovery was can be judged from the fact that the MA-4 capsule is basically the same vehicle.

Mission Objectives

The objects of the latest mission were to: (1) achieve orbit for the first time; (2) prove the ability of the capsule to withstand re-entry temperatures eight times longer than in any previous Mercury launching; (3) demonstrate the ability of the modified Atlas launching vehicle to release the capsule at the precise speed, altitude and injection angle for orbital flight; (4) prove the integrity of the spacecraft and its integral systems for nearly two hours; (5) exercise for the first time the World-wide Mercury tracking, data-gathering and communication network; and (6) check the ability of the retro-rocket system to return the capsule from orbit.

The proposed launching sequence was basically the same as that specified for the MA-3 capsule (THE AEROPLANE AND ASTRONAUTICS, May 4, 1961, p. 481). Briefly, this involved launching the Atlas on a heading of about 70 deg. just north of east from Cape Canaveral. During the first 2½ minutes of firing, the vehicle's Abort Sensing and Implementation System (ASIS) would be capable of sensing trouble and could trigger the Mercury escape rocket to pull the capsule away from the Atlas booster. After the jettisoning of the Atlas lateral boost engines and the firing away of the escape pylon mounted on top of the capsule, the mission could still be terminated by the ASIS, if a significant deviation occurred in the trajectory, by releasing the clamp ring securing the capsule to the Atlas and firing the "posi-grade" rockets on the base of the spacecraft.

If all went well, however, about five minutes after lift-off the radio-inertial guidance system—measuring speed, altitude and flight-path angle—would receive a command from the ground to shut down the sustainer and vernier engines of the Atlas main stage. As thrust terminated, the spacecraft-to-booster clamp ring would be released and the "posi-grade" rockets would fire to separate the capsule.

After a few seconds of automatic damping, the capsule would then be turned through 180 deg., so that the blunt heat shield was facing forward in the path of flight. The actual flight attitude is 34 deg. above the horizontal and this is assumed automatically. From this point on, during orbital flight, the spacecraft's attitude is controlled by horizon sensors, maintaining the correct attitude with respect to the Earth's surface.

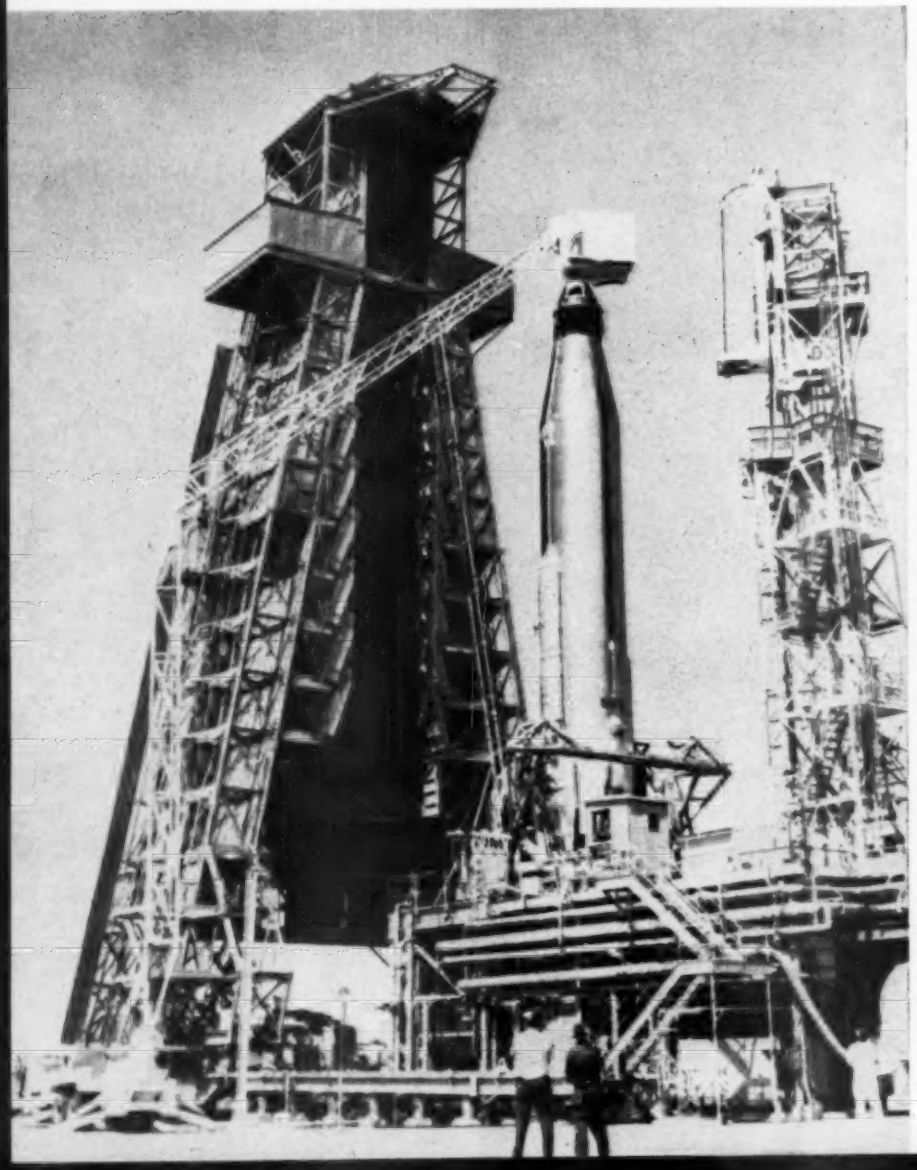
Acceleration Loadings

The intention was for the Mercury capsule to be injected into orbit some 100 miles above Bermuda at a speed of about 17,400 m.p.h. Launching acceleration was expected to reach a maximum of more than 7½*g*, with re-entry loading at about 12*g*. The entire mission was scheduled to last about 110 minutes, with the capsule orbiting at a maximum altitude of 154 miles and a minimum altitude of 100 miles. Apogee would be reached somewhere off the west coast of Australia and perigee near Bermuda.

Towards the end of the first orbit, with the capsule approaching the west coast of Mexico, a timing device on board was intended to fire the retro-rockets and initiate re-entry. The landing, as mentioned earlier, would be some 200 miles east of Bermuda. In the event of the timer failing, a radio command signal from the tracking station at Guaymas, Mexico, would be used to trigger re-entry.

On a normal mission, maximum heating conditions—about 2,000° F.—will be encountered at 37 miles altitude while the capsule is moving at nearly 15,000 m.p.h. Temperatures in this region must be borne for six to seven minutes, which is about eight times longer than that sustained during Atlas-boosted ballistic flights (i.e., Big Joe and MA-2). This is due to the flatter orbital re-entry angle, only 2 deg. as against 6 deg. to 7 deg. in early sub-orbital tests.

(Continued on page 231)



With the Atlas-D booster framed between the missile gantry and a servicing tower at Cape Canaveral, technicians ride in a "cherry picker" hoist to make final adjustments to the Mercury capsule.

AIR TRAFFIC CONTROL

Television can present tabulated flight progress information instantaneously wherever it is required in an air traffic control centre.

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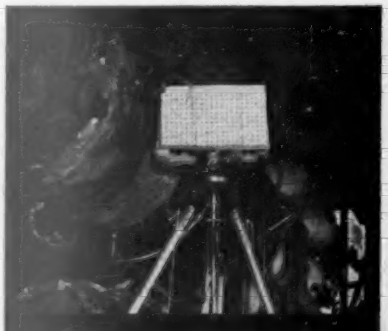


RESEARCH

Observation of after burning in a gas turbine engine at a government research station. This is typical of the many research applications for which television is being used to-day.

ROLLS-ROYCE

Since the 1960 S.B.A.C. Display, Rolls-Royce has continued to grow in size and activities, and its Aero Engine Division alone now employs 40,000 people of whom 9,500 are engaged on research and development work. In total the company has over 49,000 employees.

Exports by the company last year rose to the record level of more than £53m., largely through the sale of aero engines and spares. With 27 million hours of experience in civil and military operation Rolls-Royce turbine engines are now in service with or on order for 95 airlines and 32 armed forces around the world.

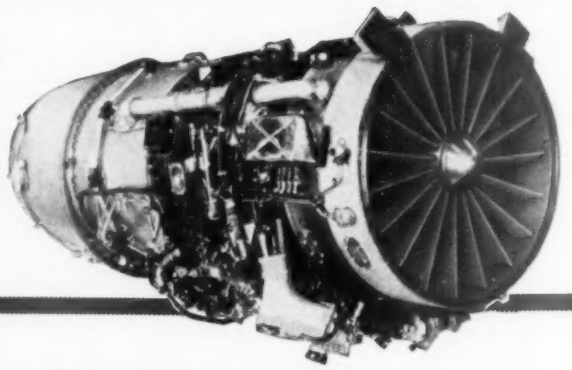
Highlights of progress with Rolls-Royce aero engines in 1961 are given here.

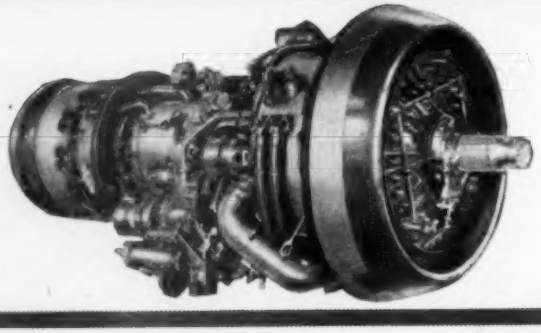
CONWAY

World record overhaul life for by-pass jets — 1,700 hours.

Development running of 20,250 lb. thrust R.Co.42 started.

Increased airline orders for VC.10 and Super VC.10.





TYNE

Introduced into airline service with BEA, TCA, Seaboard World Airlines and the Flying Tiger Line.

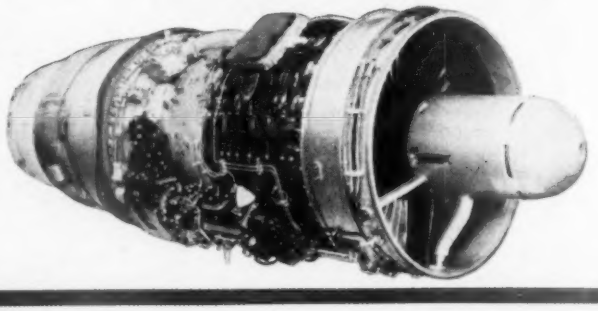
Roll-out of prototype Breguet Atlantic NATO maritime reconnaissance aircraft.

AVON

World record overhaul life for turbo jets — 2,900 hours.

First British turbo jet on domestic services in America in UAL Caravelles.

Latest military version entered service with R.A.F. in Lightning.



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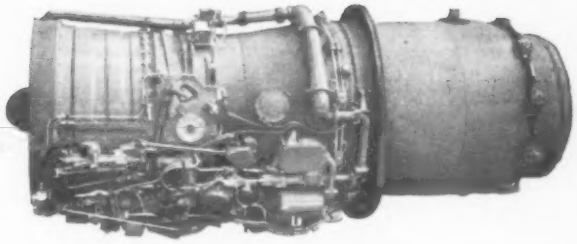


SPEY

Selected to power the new BAC One-Eleven transport.

Government development contract for military version to power Buccaneer S.2.

Ground running trials in the Trident completed.

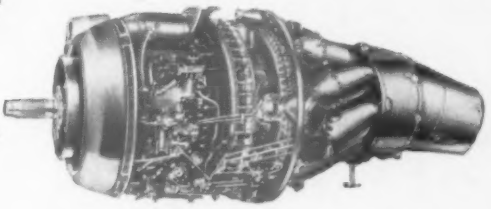
DART

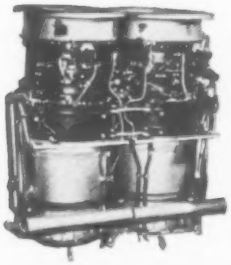
Highest overhaul life ever reached by any aero engine — 3,200 hours.

Entered service in Argosy with Riddle Airlines in America.

Entered service in Herald with Jersey Airlines.

Received joint ARB/FAA type certificate at 3,030 e.h.p.





JET LIFT

Development running of RB.145 jet lift engine started.

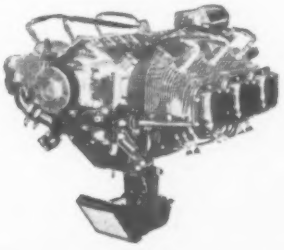
Joint development of RB.162 jet lift engine with France and Germany announced.

Rolls-Royce jet lift engines specified for military VTOL and STOL projects.

LIGHT AIRCRAFT ENGINES

Engines manufactured by Rolls-Royce under licence from Continental Motors scheduled for delivery 1962.

Several new British aircraft to be powered by Rolls-Royce Continentals.



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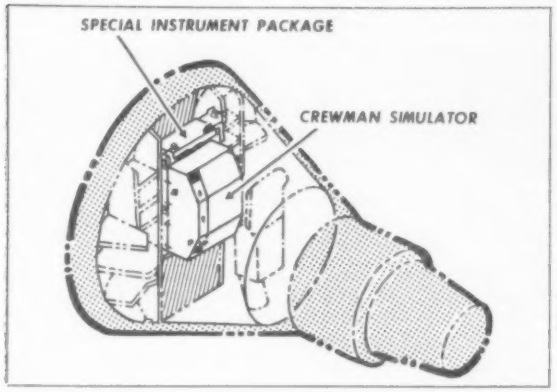

This diagram shows the position of the crewman simulator in the Mercury MA-4 capsule.

The Mercury MA-4 capsule is here being hoisted to the top of a gantry before being installed on the nose of the modified Atlas-D ICBM.

Following re-entry—speed having dropped from 17,000 m.p.h. to 1,350 m.p.h. in little more than three minutes—a 6-ft. drogue parachute was scheduled to deploy at about 42,000 ft. When the vehicle had descended to an altitude of some 10,000 ft., the antenna fairing (mounted above the capsule's cylindrical section) would be jettisoned to release the 63-ft. ringsail main landing parachute.

Unlike later production capsules, the MA-4 was not being equipped with a landing bag, nor was it considered necessary to embody a jettisonable hatch such as the one embodied in Liberty Bell. The capsule's launching weight was given as about two tons, which includes the 900-lb. emergency escape system, which does not enter orbit.

The MA-4 spacecraft, which measures 6 ft. across the maximum section and 9 ft. from the heat shield to the top of the parachute container, had all the equipment necessary for operating the vehicle on an automatic basis. In addition to the standard integral systems, through which a human astronaut would control the vehicle, electronic equipment and sensing devices had been installed to try to duplicate "man's judgment and corrective capacity."

The manual part of the attitude control system had been closed off in the case of the MA-4, but other equipment was installed to simulate the function of a human occupant. The crewman simulator—or, as it is described in America, the "breathing, sweating and talking robot"—is an essential element of the early orbital missions. Strapped to the place which is normally occupied by the astronaut's couch, the simulator consumes oxygen, expels carbon dioxide and fills the cabin with heat and moisture, much as a human astronaut would in the course of normal breathing. The astronaut's voice was being simulated by two 45-minute voice tapes which were intended to broadcast pre-recorded messages to Mercury ground stations, allowing them to check on HF and UHF transmissions.

Another tape-recorder was being placed in a position close to where the astronaut's head would be, as a means of recording noises experienced during the flight. A special colour camera was mounted behind one of the two portholes to observe the Earth. Another camera "looked through" the astronaut's periscope, while a third was installed to photograph the instrument panel.

In addition, special instrumentation had been mounted in the capsule for the purposes of recording vibration, acceleration and temperature.

A "Workshop" on Satellite Meteorology

MORE than 100 nations have been invited to send representatives to an International Meteorological Workshop to be held in Washington from Nov. 13 to 22. The invitations have been extended in letters to the directors of foreign meteorological services by Dr. F. W. Reichelderfer, Chief of the U.S. Weather Bureau, and Dr. Hugh L. Dryden, Deputy Administrator of NASA.

The Workshop, the first of its kind ever held, is being arranged by Weather Bureau and NASA scientists with the co-operation of scientific and international groups. By means of lectures and laboratory work it is hoped that meteorologists from all parts of the World will gain increased understanding of the usefulness of data obtained from meteorological satellites.

Although, as NASA point out, the three Tiros launchings have demonstrated the potential of the weather satellite, the introduction of satellite information into routine use on a day-to-day basis has presented a number of problems, many of which are still only partially solved. It is now felt, however, that several new techniques which have been developed are sufficiently advanced to permit demonstration and discussions among meteorologists of the World.

The countries invited have been asked to send one or two meteorologists to the 10-day gathering. These representatives will hear a series of short lectures on the engineering aspects of the Tiros satellites, significant research results, the data acquisition system, and programme plans for future meteorological satellite systems.

In laboratory-type meetings, the participants will use actual satellite photographs to prepare weather analyses. In this way, they will gain practical experience in the use of satellite data distributed by the United States through international meteorological channels.

If a weather satellite is functioning at the time, the participants will also be shown the principal ground elements of the system in operation.

No More Sub-orbitals

THE National Aeronautics and Space Administration announced on Aug. 18 that it was discontinuing its sub-orbital Mercury launchings and will now devote its full energies and resources to putting an American astronaut into orbit. Analysis of data obtained during all Redstone-boosted sub-orbital missions indicates that the objectives of this phase of the programme have been achieved. The object of these initial tests—the last two involving human astronauts Cdr. Alan Shepard and Capt. Virgil Grissom—"was to gain in-flight experience and qualification for the spacecraft and its systems." NASA's Space Task Group will now concentrate on the orbital phase of Project Mercury and to follow-on manned flight programmes, including Project Apollo. A new evaluation of all pertinent pilot data will be made to select astronaut candidates for orbital flight. All seven of those at present in training will be considered for such missions.

In the Redstone-boosted test launchings, comprehensive information about the capsules' flight performance was obtained from telemetered data from the ascents of Shepard and Grissom and also from two earlier unmanned shots. Investigation into the cause of the loss of the Liberty Bell capsule is continuing, according to NASA. So far, there has been no indication that an additional Redstone launching would be required in order to rectify the faulty hatch operation which was experienced.

Lessons of Weightlessness

THREE lessons, all of them somewhat unexpected, have emerged from Major Titov's experience of being weightless for 24 hours—one can hardly describe it as a day and night, for the dawn broke on him 17 times. First, he said that his sensations "reverted to normal" within a few seconds of the onset of weightlessness, after a momentary feeling that his feet were above his head. Then, after nine hours of it, when he slept (and overslept), he had no dreams—not even of a "falling sensation."

This, however, may have been due to his being awake when the weightlessness began. In an experiment conducted in the United States about three years ago, a "subject" was prevented from sleeping for 48 hours, then put in an aeroplane and bedded down, whereupon, not unnaturally, he promptly fell asleep. The aeroplane then took off and entered a "weightless trajectory," i.e., an imitation of the parabolic path and speed variation of a passive missile; whereupon the "subject" woke up with an uncomfortable feeling that his limbs had "floated away" from him.

This observation could have been interpreted, at the time, as proving that sleep is impossible when one is weightless, however urgently one needs it. Major Titov has disproved this idea; it is the onset of weightlessness, rather than its continuance, that is so disturbing. However, there are people who cannot stand its continuance either; Dr. S. J. Gerathewohl reported in 1956 how he had sent 16 subjects up on weightless trajectories of about half a minute each, and found that, though eight actually enjoyed the experience and five were indifferent to it, three became ill and took time to recover. We can take it for granted that all four astronauts, Russian and American, were tested in this way before being chosen.

Now we come to the most noteworthy symptom brought on by weightlessness, namely, that Major Titov got unpleasant sensations whenever he made sharp movements of his head, but they "almost" disappeared when he refrained from doing so. There are two possible explanations.

First, there is the "Weber-Flechner law" of the neurologists, which states that the nerves register a change in the strength of a stimulus not according to the actual change but according to the proportional change. The law works well within limits for vision, hearing, and other senses. But when applied to gravity, it means not only that a change from 0.001 *g* to 0.002 *g* should produce the same stimulus as a change from 1 *g* to 2 *g*, but also that a change from zero *g* to any acceleration at all would produce a stimulus of infinite strength, which is impossible.

Nevertheless, attempts at such a strict application of the Weber-Flechner law have led to a prophecy that, under weightlessness, the slightest movement of the head would cause a stimulus of intolerable severity from the balancing organs of the inner ear, which are known to be largely responsible for travel sickness of all kinds.

But there is a more plausible explanation of how the balancing organs could have been responsible for Major Titov's discomfort, which, after all, only became severe when his head movements were "sharp." These organs exercise involuntary control not only of the muscles used in balancing, but also the muscles which move the eyes in such a way as to compensate for movements of the head, so that they enable you to keep your eyes fixed on an object without having to keep your head still.

There are two sets of balancing organs in the inner ear. First, the semicircular canals, which every blind-flying pilot has heard about. They contain fluid, and detect angular accelerations, i.e. not angular velocities, but only *changes* in angular velocity. On each side of the head there are three, arranged in three different planes, and the sensory detectors lie round a bulge at one end of each canal; the bulge is stretched when the fluid flows towards it, and relaxed when the fluid flows the other way.

The other set consists of "otolith organs," two on either side. Each lies on the wall of a cavity, and consists of a layer of tiny chalk particles (otoliths or "ear-stones") embedded in a jelly. Tiny hairs project into the jelly from a layer of "hair cells," which in turn are surrounded by nerve fibres. The inertia of the chalk particles causes them to move in the jelly under the influence of linear accelerations; the hairs are bent, the cells are distorted and the nerves send a message to the brain describing (in a code consisting of impulses of equal strength but variable frequency) what they "think" is going on.

For this purpose gravity counts as a linear acceleration, and so does centrifugal force set up by turning the head, as the otolith organs are outside the centre of gravity of the skull.

For the spaceman's palate. An array of food containing concentrated vitamins, proteins and carbohydrates, some of it in "squeezable" plastic tubes. The screw caps are tethered in case they come loose in the cabin under weightless conditions. The picture is from the Soviet documentary film, "With Gagarin to the Stars."

Now, under normal conditions, the otoliths are being pulled downwards by gravity; then, if the head is accelerated in a horizontal plane, they lag behind and are pulled horizontally the opposite way in relation to the hair cells. The resultant of these two directions is a pull downwards at an angle, but the brain interprets this correctly as a horizontal displacement, and orders the eyes to move horizontally in compensation.

But if the same head movement is made in the absence of gravity, the only pull on the otoliths is horizontal. The brain, however, interprets this pull as compounded of the downward pull of gravity plus an imaginary upward pull on the otoliths caused by the head accelerating downwards; to compensate for this imagined downward motion of the head, it orders the eyes to move upwards, and the result is an optical illusion that the environment is moving downwards past the eyes. Such an apparent motion of the environment in unexpected directions is almost certainly the main cause of seasickness and airsickness, so now it must take the blame for space sickness as well.

A disturbing feature of Major Titov's experience is that 24 hours was not long enough for him to become adapted to the new conditions, for he admits that he only got relief when his weight began to return as rocket braking was switched on for the descent. Yet a few short weightless parabolas are enough for a subject to learn to perform tasks which are botched at first because arm muscles pull against a weight which is not there. To reach the Moon, where the value of gravity is only one-sixth *g*, takes little more than a couple of days or so—hardly long enough to cure the otolith organs of their trick of sending false information to the brain.—A.E.S.

Probing the Dustiness of Space

FIRST analysis of the dust-like particles captured in space by the micrometeorite trap carried in the nose-cone of an Aerobee-Hi rocket launched in June (THE AEROPLANE AND ASTRONAUTICS, Jly. 6, 1961, p. 15) has indicated that a "dense band of cosmic dust surrounds the Earth at extreme altitudes." The project is being carried out jointly by the U.S. Air Force Cambridge Research Laboratory and Northeastern University. Aerojet-General designed and built the special nose-cone.

The experiment seems to have been highly successful. When the rocket reached an altitude of about 40 miles its nose-cap slid forward to allow the eight petal-like leaves to open out. They remained open as the vehicle coasted to the zenith of its trajectory at 102 miles and until it had fallen to 55 miles. The leaves then retracted and the nose-cap slid back over them again to afford protection when passing through the lower atmosphere. Separation of the nose-cone occurred at 50 miles, with recovery by a two-stage parachute system.

Aerojet-General have announced that the thin layers of plastic on the leaves caught a sufficient number of samples of dust to keep scientists busy for a year or more.

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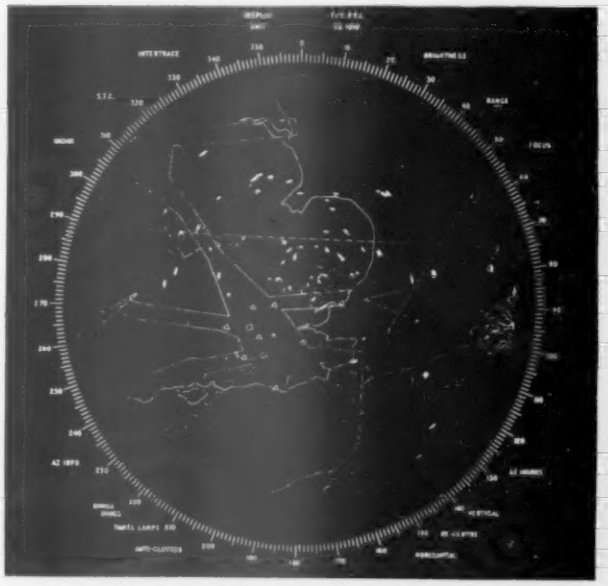

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Fiat G 91 T trainer
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Folland Gnat trainer
Fuji TIF 2 trainer
Hindustan HF 24 fighter

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De Havilland Jet Dragon executive transport
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Stentor rocket engine powers . . .
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MK. 27 GROUND REFUELLING HOSE COUPLING Light, compact and robust, the coupling gives remarkably low pressure loss. Originally developed for the Ministry of Supply, then adopted by NATO and ordered in quantity by the Royal Navy, the Royal Air Force, and the Swedish and French Air Forces.

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TA 3307

Personal Flying

FOLLOWING the report by the chief inspector of accidents to the M.o.A. on the crash of a Turbulent at Orpington last December, caused by structural failure of the starboard wing during unauthorized aerobatics, a change is to be made in the issue of Permits to Fly. In future, the Popular Flying Association will make recommendations for the issue of these Permits for ultra-light aircraft to the A.R.B. instead of the Ministry. The Board will then advise the Ministry on the issue of such Permits.

Another observation made in the accident report concerned the light stick forces of the Turbulent, which were shown to be, on an average, little over 1 lb. per *g*. If these stick forces were truly representative of the type, concluded the report, then the importance of observing the aircraft's operating limitations cannot be over-emphasized. No criticism was made of material or workmanship, and it was noted that the aircraft was placarded as non-aerobatic.

• • •

A newcomer to aircraft sales in this country is Steel's (Aviation), Ltd., which is associated with the Steel's Group of garages in the Cheltenham area, and has taken over a hangar at Staverton Airport. The new company has become Western dealer for the Cessna range of light aircraft, from the sole U.K. distributors, Airwork Services, Ltd.

The Staverton enterprise is being led by Mr. Peter Dawson, who has been using his own aircraft for the past two years for business. With Mr. Dawson are Major G. H. Barrington and Mr. Peter Robinson.

• • •

The two-seat Piper Colt has been selected as the standard aero club trainer in Sweden, and an initial order for 30 of these aircraft has been placed with Jonas Aircraft Company, in New York, the Piper export distributor, through Nyge Aero, the local dealer. Selection of the Colt was made after competitive trials sponsored by the Royal Swedish Aero Club. Judges included a specially selected group of test pilots, inspectors from the Royal Swedish Air Force, flight instructors and aviation insurance underwriters.

Representatives of 38 Swedish aero clubs were also given the opportunity to fly the Colt, which was judged on flight stability, safety, suitability for forest fire patrol, flight training, glider towing and other club activities. Contributing to the Colt's selection were its almost stall-proof characteristics and general operating economy. All 30 Colts for Sweden will have additional auxiliary fuel tanks to total 36 U.S. gal. Final equipment is still under consideration, but eight will be equipped as Super Custom models, less radio, and 15 as Custom types, also without radio. First deliveries are due for mid-September.

• • •

An exercise in nostalgia is being flown by two Australians, Dr. John Morris and Mr. Bruce Harrison, who are currently en route from Sydney to London in a vintage Monospar light twin. They are retracing the original air route, established between Sydney and London 30 years ago by Australian airmen, in one of the few surviving aircraft of its type.

When last reported, the Monospar and its crew had reached Baucau, in Portuguese Timor.

• • •

The Aero Commander Model 1121 twin-jet executive aircraft, which is at present being designed in the United States, will be certificated under the transport category (CAR 4b) of the F.A.A. regulations. This has been made possible as a result of the modification of certain technical requirements such as the otherwise mandatory aisle width stipulation for transport aircraft.

According to Mr. T. R. Smith, vice-president engineering of Aero Commander, Inc., development of the Jet Commander is ahead of schedule. Following photographic tests, the cockpit visibility has been found to exceed that of a number of other aircraft already certificated in the transport category. The planned performance capabilities of the Jet Commander have matched or exceeded the turbine transport requirements in F.A.A. Regulation SR 422B.

Deliveries of this 500 m.p.h., six/eight-seat executive aircraft are scheduled for the third quarter of 1963, at a firm f.a.f. price of $475,000. Orders have already been received.

Gliding Notes

by Dr. A. E. Slater

A TWO-SEATER duration record of 71 hr. 1 min. 43 sec. is reported from Hawaii, though the Press did not give the pilots' names. However, Alex Aldott writes from Chicago that they were Geza Vass and Guy Davis, and that the former is, like him, of Hungarian origin. Since 1954 duration records have no longer been recognized by the Fédération Aéronautique Internationale. The last such record, officially, was 57 hr. 10 min., set up by B. Dauvin and H. Couston in France on Apr. 6-8, 1934. The single-seater duration record at that time was 56 hr. 15 min. by C. Atger, also in France, on Apr. 2-4, 1952.

This is not the first time Hawaii has been the scene of an international duration record. Lieut. W. A. Cocke, of the U.S. Air Corps, took off at 3 p.m. on Dec. 19, 1931, from the base of Nuuanu Pali, and landed 21 hr. 36 min. later to find that his "Nighthawk" was the only glider to survive a "meet" which had been going on down below.

He beat a record of 14 hr. 7 min. set up by Lieut. F. Dinort at Rossitten in East Prussia in 1929, seven months before I took a course there. Dinort similarly flew through the night, well wrapped up because he sat in an open bucket-seat exposed to the elements. I was told that his supporting team was kept busy relighting the hurricane lamps (placed along the sand dunes) as fast as the wind blew them out.

• • •

WAVES provided good soaring at both the London and Bristol Clubs on Sunday, Aug. 20, when a strong W.N.W. wind blew in advance of a warm front which reached Nympsfield at 8 p.m. At Dunstable several people found a good wave a little way to leeward of the summit of the Downs, though the only steep escarpment faces to windward. Charles Ellis picked it up there and soared along it sideways 9 miles to Barton, which is to windward of the last of the Chiltern Hills to the N.E. He got a maximum height of 4,700 ft. and, although there were no clouds to indicate the wave until later in the day, he saw some lines of small cumulus away down below which, though not wave clouds, appeared to form directly below the upgoing zone of each wave.

At Nympsfield, after a layer of strato-cumulus had dispersed, wave clouds appeared high up, as well as thin cumulus below, so two members had tows in Skylarks but could only find bands of zero sink. About midday the clouds thickened and waves could be seen lower down.

So Douglas Jones had a tow in his Skylark 3f and released at 3,800 ft. in 17 ft./sec. lift under a bank of cloud between Nympsfield and Bristol. The lift was smooth and took him up through the cloud and out at its top at 7,800 ft. From that height he saw an almost unbroken layer of cloud hills and valleys both upwind and downwind, but the next wave upwind was weaker.

Later, Tony Pentelow also reached 7,800 ft. a.s.l. over the Welsh side of the estuary, and John Daniell 6,800 ft. After this the warm front got so near that clouds descended on the hill and three people had to land out.

On the previous day the wind blew directly up the hill and 65 hours were flown.

From the London Club a week earlier, "Chuck" Bentson flew via Norwich and Tibenham to Swanton Morley, 87 miles. Two days before that, Geoffrey Stephenson set off on a 300-km. triangle via Lasham and Nympsfield, but had to cut off a corner at Cirencester before the second turning point. And a week before that he made an out-and-return between Dunstable and Malvern for the third time.

On Aug. 7 Alan Yates, principal of Bath Technical College, took off from R.A.F. Bannerdown Club at 11.30 hrs. and flew via Oxford to Hopton, West Suffolk, in an attempt to reach Yarmouth.

• • •

KENT GLIDING CLUB, which had to leave Lympne some months ago, have been offered the use of West Malling airfield by the U.S. Naval unit based there. They expect soon to have some American members.

• • •

PHILIP WILLS won the Italian Championships which were held from Aug. 1-13, flying his own sailplane; but he has not returned at the time of writing. Dr. Brennig James also took part.

The National Aerobatic Competition will be held as usual at Dunstable. The date is Sunday, Sept. 24. Entry forms are obtainable from the British Gliding Association.

The annual dinner and dance of the Kronfeld Club is fixed for Oct. 6. Tickets are 30s. single, 50s. double.

Correspondence

Hovercraft Efficiency Improvements

MOST efforts to improve the performance of land-effect vehicles have been directed to the shape of the periphery jets retaining the "air bubble." With present-day knowledge of aerodynamics this cannot be far from perfection, and for any further improvements other means will have to be sought.

I am of the opinion that a considerable increase in efficiency could be gained by ionizing the air flowing through the periphery jets, and having an attachment on the underside of the machine inboard of the jets, carrying an opposite charge to the ionized air. This would draw the ionized particles of air inwards to deposit their charge prior to spilling outboard, thus retaining the air beneath the vehicle for a longer period and making it double-back upon itself, thus giving more lift for the same pressure and flow.

I anticipate that this increase in lift would far outweigh the extra weight and power consumed by the addition of the static generator. It is realized that this system may be rather a problem for sea-going vehicles due to the shorting of the static charge, but there may be methods of overcoming this. In any case, where this extra lift would be most useful would be on land-going vehicles and travelling over rough terrain where extra lift is necessary and the shorting problem would then not apply.

Perhaps some of your readers who have more knowledge of static electricity than myself may find flaws in this proposed scheme.

Farnham, Surrey. H. STANTON.

Squadron Aircraft Photographs Wanted

MAY I appeal through your columns for photographs of any R.A.F. bomber aircraft in squadron service. I am at present completing a book to be published next year on the R.A.F.'s bomber squadrons, past (including their R.F.C./R.N.A.S. predecessors and the Commonwealth and Allied units which flew with the R.A.F. during World War II) and present, and although I have some 1,200 photographs of *squadron* aircraft I still have many gaps to fill.

My list of wants is far too complicated to give here in detail, but to mention just a few, I need photographs of (1) Lancasters of practically all the 1, 3, 5 and 8 (P.F.F.) Group squadrons, (2) Mosquitos of the P.F.F., (3) Italian- and Far East-based Liberators, and (4) home-based Hawker Hinds, Audaxes, Battles, Blenheims, etc. of the "Expansion Scheme" period. The biggest gaps are in the latter category.

In all cases photographs should show *complete aircraft*, and their squadron markings (when carried), or at least the aircraft's serial numbers, should be visible.

If any readers can help me, by loaning either negatives or prints for copying, I would be most grateful if they would drop me a line. My book is to be profusely illustrated and there is every chance that their contributions—be they F.E.2bs, Halifaxes or Washingtons—will eventually appear in print. I shall, of course, take great care of any negatives, etc., and shall return them to their owners with all possible speed.

London, N.15. P. J. R. MOYES.

[Replies should be addressed direct to Mr. Moyes at 128 Vartry Road, South Tottenham, London, N.15.]

Sir Victor Sassoon

IN his younger days Sir Victor Sassoon, then known as E. V. Sassoon, and Ellice to his intimates, was one of the early band of Brooklands pilots in 1910 and 1911. He was then about 30 years of age and, as most of the pilots there were aged about 20, he was known as "Daddy."

At first he flew under the pseudonym "Mr. Partridge"; as his family didn't approve of him flying he tried to keep it secret. Sir Thomas Sopwith, then one of the Brooklands "youngsters," has told how "Daddy" Sassoon was joint owner of a 2-seat Bleriot with Otto Astley. Daddy, who was a bit short-sighted, was flying the machine one day and made a beautiful landing—but 20 ft. up in the air with the inevitable result of a nice crash. It took several weeks to repair and next time he flew Otto said to him: "Now, Daddy, fly the b———y thing right on to the ground before you flatten out." *And* he did! But no personal injuries.

Daddy caused much amusement with an apparatus known as the "wind waggon"—a sort of ancestor of the Rolls-Royce Flying Bedstead. He had an interest in the A.B.C. engine firm so, to test propeller thrust, he mounted an A.B.C. with a propeller on a lorry chassis which he drove round Brooklands track at a high rate of knots to the amusement of everyone.

Before his family forced him to quit the dangerous aviation game, and in spite of his short-sightedness, he qualified for Aviator's Certificate No. 52 on Jan. 24, 1911, on a French Sommer biplane at Brooklands. The next certificate in the list, 53, was taken by Geoffrey (now Sir Geoffrey) de Havilland at Farnborough. So Sassoon was one of the real pioneers of British aviation.

London, W.14. GEOFFREY DORMAN.

TV Errors

I AGREE wholeheartedly with Geoffrey Dorman's plea for more careful checking by the TV authorities on pronouncements of facts in their aviation programmes.

I think perhaps the worst "clanger" of recent months was the episode in the generally very excellent American record of Sir Winston Churchill's "Valiant Years" when we were shown a quick flash of a Blackburn Ripon dropping the torpedo that crippled the "Bismarck"!

London, E.C.1. CHARLES SIMS.

Wroundabout

Farnborough Preview

One of the litter of Beagles to be seen at the S.B.A.C. Display is described by its makers as "a bright new star," "the Rolls-Royce of the Air" and "the first of its type to be fitted with a toilet." It is thus the World's only canine, astral, airborne car with sanitation.

*

The above aircraft should not be confused with the "Gipsy-engined Austin" which, according to a recent small ad., the West London Aero Club are looking for. That product, the first to emerge from the new Beagle-Austin company resulting from Peter Masefield's take-over of B.M.C., cannot be spared from its taxi trials to be shown at Farnborough.

*

"An interesting aircraft. If it's at Farnborough I'd consider it worth putting my glass down for."—*From the D.H. Gazette, the last issue of which appears in time for the S.B.A.C. Display. Then it will be merged in the new Hawker Siddeley Aviation Review, due out in October.*

*

The magazines may contract but the Display continues to grow and offer new attractions. This year there's a B.B.C. studio, an extra row of enclosures, the S.B.A.C. have even enlarged their own office, and the mighty Blue Streak will be there, an 85-ft. problem of transport, pressurization and installation. There's a feeling among the men working on it that this year's Show should have been at Woomera—proper erecting facilities *and* perfect weather. They could even have *fired* some of these taciturn tubes.

*

"The Treasury pundits are like a lot of inverted Micawbers, waiting for somebody to turn down."

*

by Wren

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HOW ARE THINGS SHAPING AT SHANNON?

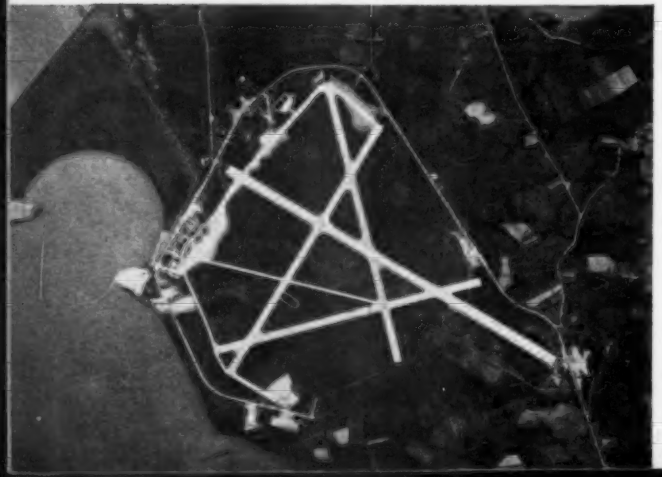
Why is Shannon so important?
There are three principal reasons. Shannon Airport is World-renowned as a transit stop for trans-Atlantic traffic. It is a Customs-free airport, the first to be opened in Europe. And it embraces the World's first air cargo industrial estate, using air freight well-nigh exclusively for the distribution of goods to World markets.

When was it established?
Construction of the airport began in October, 1936 but its runways were first opened to international and trans-Atlantic traffic after the war, on October 16, 1945. It became a Customs-free airport in 1947 and building construction on the industrial estate began about eighteen months ago.

How about Esso's history at Shannon?
In the early 1950's Esso, in close collaboration with the airport authorities, evolved and installed a hydrant refuelling system at Shannon—the first of its kind in the Eastern Hemisphere. And among Esso's airport staff at that time were those who had made much earlier refuelling history in that area when, in 1937 at Foynes, they refuelled the first trans-Atlantic aircraft to arrive there. That was a Sikorsky S-42 flying boat; eight years later the same crew refuelled the first trans-Atlantic landplane—a DC-4— to use Shannon Airport.

What's happening there today?
Some fifteen international airlines operate at Shannon, and already five carriers fly all-cargo services into and out of the busy airport. The demand for fuel is heavy and time is at a premium. Esso's installation is geared to meet this demand, with a staff of more than 50, a fleet of 16 vehicles including hydrant servicers and refuellers—and large-capacity Hydrafuellers soon to come—combined with a hydrant system incorporating the latest developments and improvements. And Esso is prepared to meet the heavy future demands foreshadowed by current developments at the airport: developments which have changed its appearance noticeably in the past few years.

When did Shannon look like this?
This photograph shows Shannon as it appeared in the early 1950's.



In contrast, a glance at this recent view shows two new important features. In the background there is the new 10,000 ft. jet

runway, 006/24. In the foreground there is the new air cargo industrial estate which with the parallel development of a large residential community, has a long-term target to make provision for 30,000 people with 250 acres set aside for factories.

What is the significance of the industrial estate?
It represents a tax-free haven at a cross-roads of World-trade, enabling merchants and manufacturers to bring in materials for storage, manufacture, processing and assembly. Customs duties do not arise in the free trade area: and dispatch of finished goods to World markets is simply a matter of loading aboard an aircraft straight from factory shelves or parking line. Since production began in September, 1960 more than 250000 kg. of freight has been generated from the estate alone. By the end of 1961 this figure will have reached two million kg. and output may well be four times as great by 1965.

So what is the shape of things to come at Shannon?
A new look in air transport: increasing passenger traffic supplemented by a swelling volume of aerial freight. The big jet passenger transports soon to be joined by specially-designed turbo-prop freighters, and later by pure jet freighters, bearing bulk cargoes for transhipment at Shannon's new freight terminal for distribution by short-range freighters to European destinations. It is an exciting prospect for Shannon and for Esso, whose research scientists and design engineers, are already anticipating these trends, working ceaselessly to ensure that safe swift service in the Esso **tradition** is as fair a claim in the future as it is at Shannon today.

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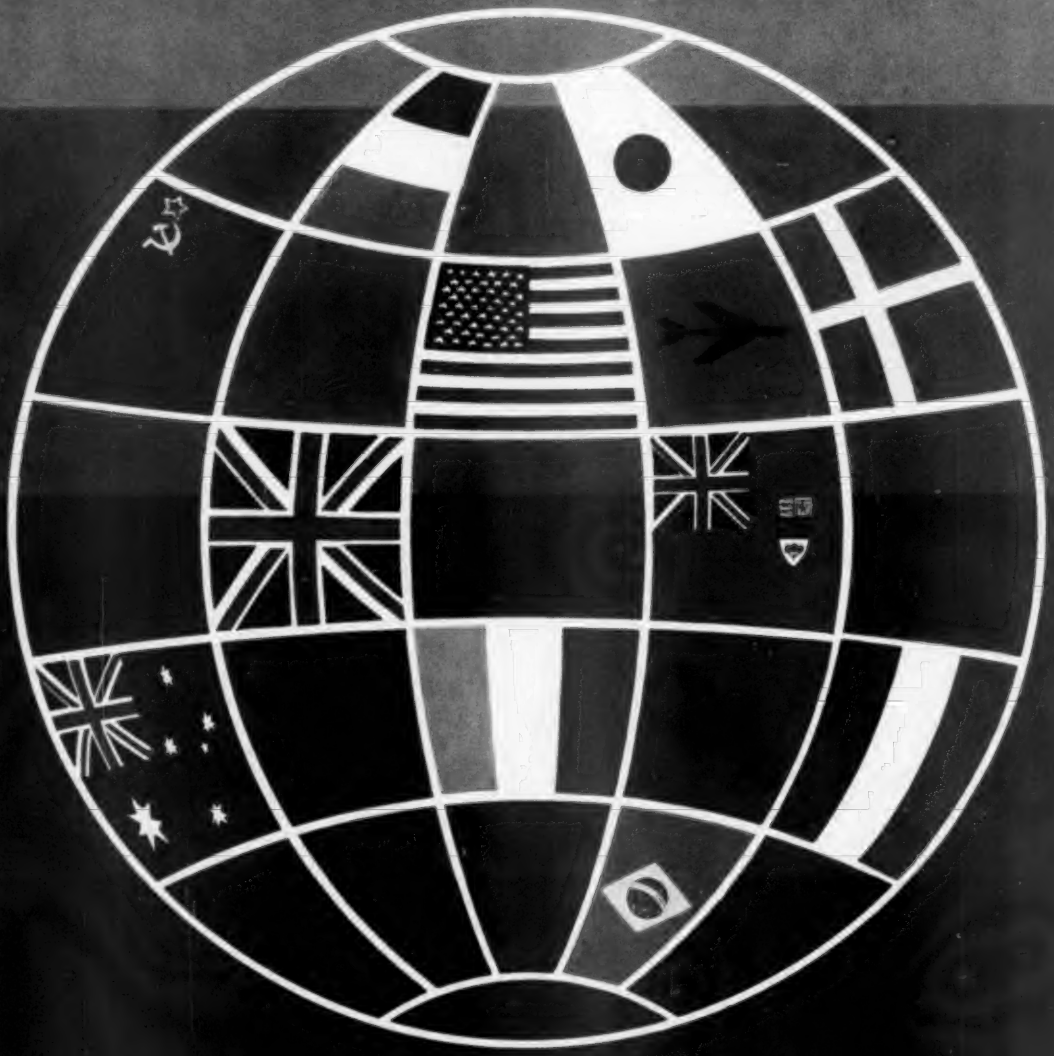
Shannon Airport first attained importance as a flying-boat refuelling centre.

Irish International Airlines Boeing 720-048 Flagship "Padraig" (St. Patrick) receives fast Esso service from the hydrant fuelling system at Shannon.



FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160 Mirage 3
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T JAPAN: Namco YS11
HOLLAND: Fokker Friendship USA: Boeing 707 USSR: Rover APU

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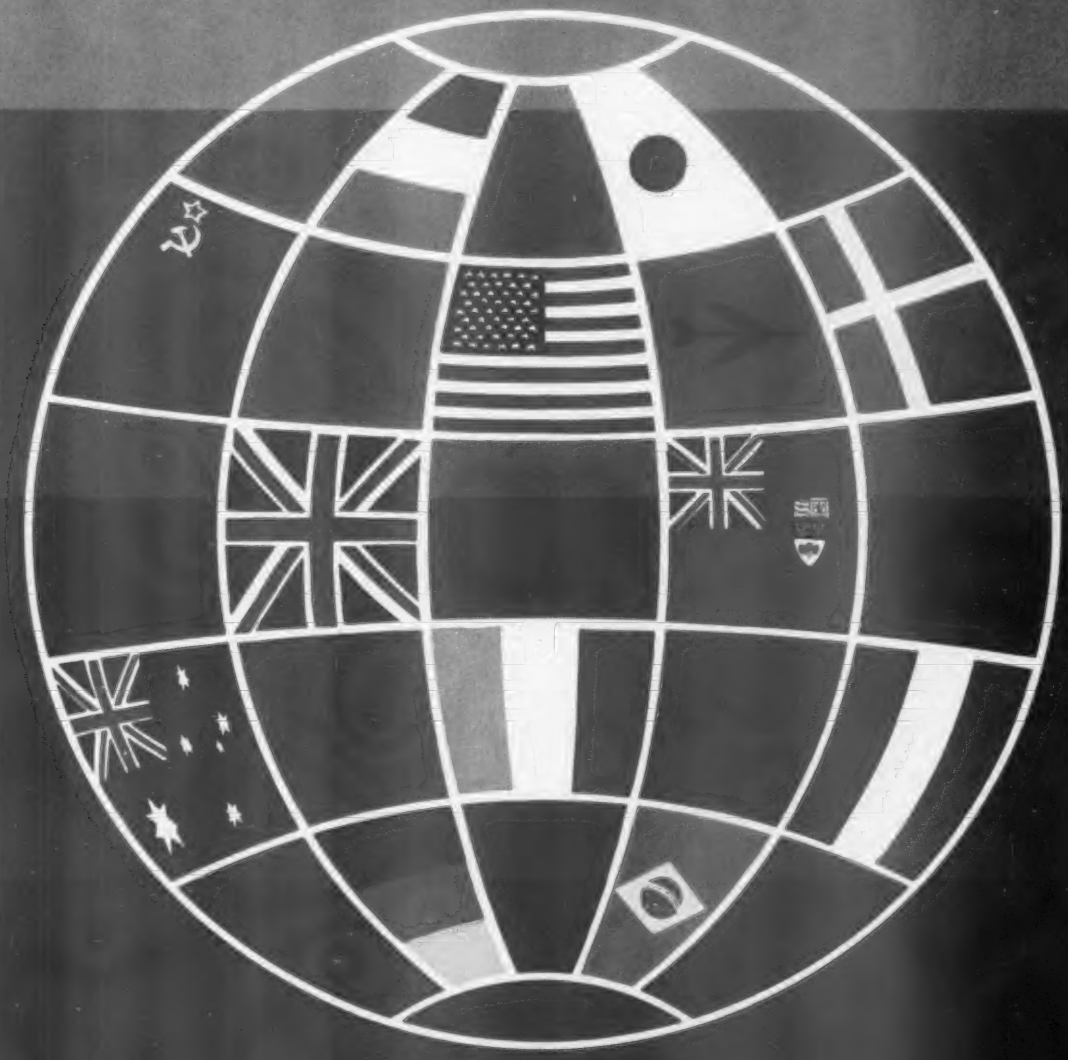

FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T Macchi MB326
GERMANY: BMW engine type 6002 Dornier Do27 & Do28 JAPAN: Namco YS11
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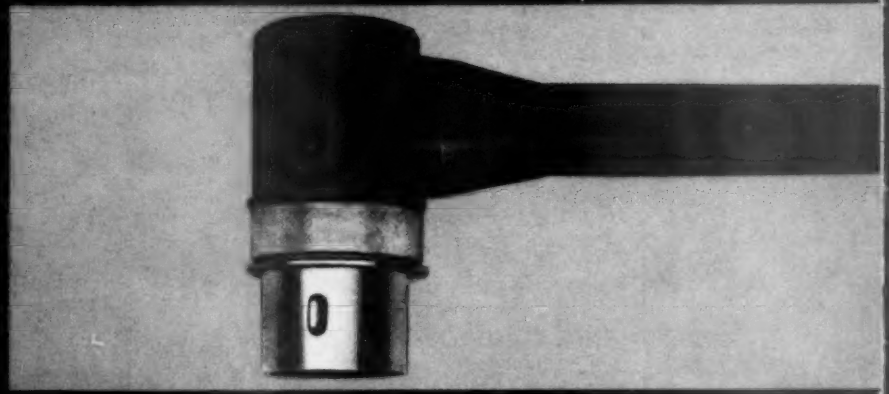

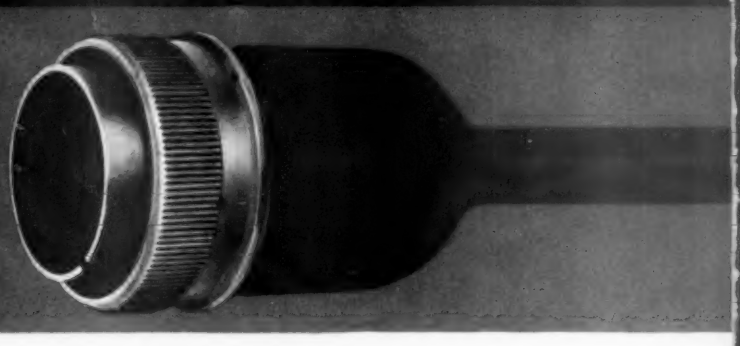

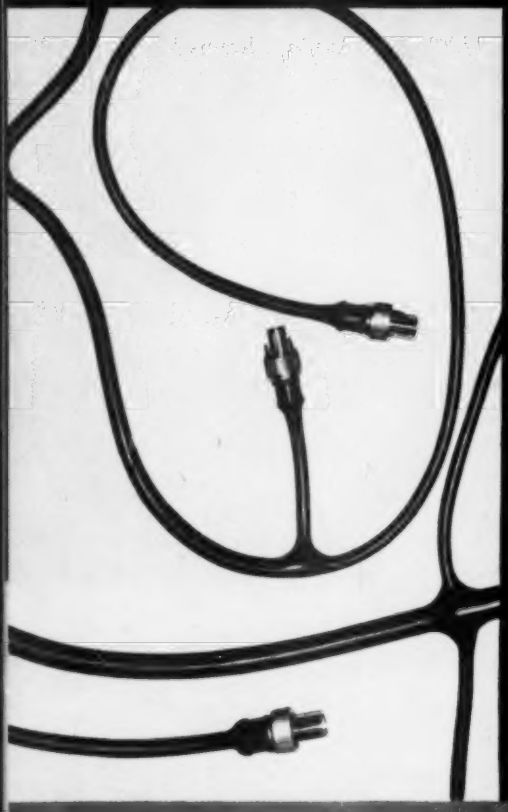

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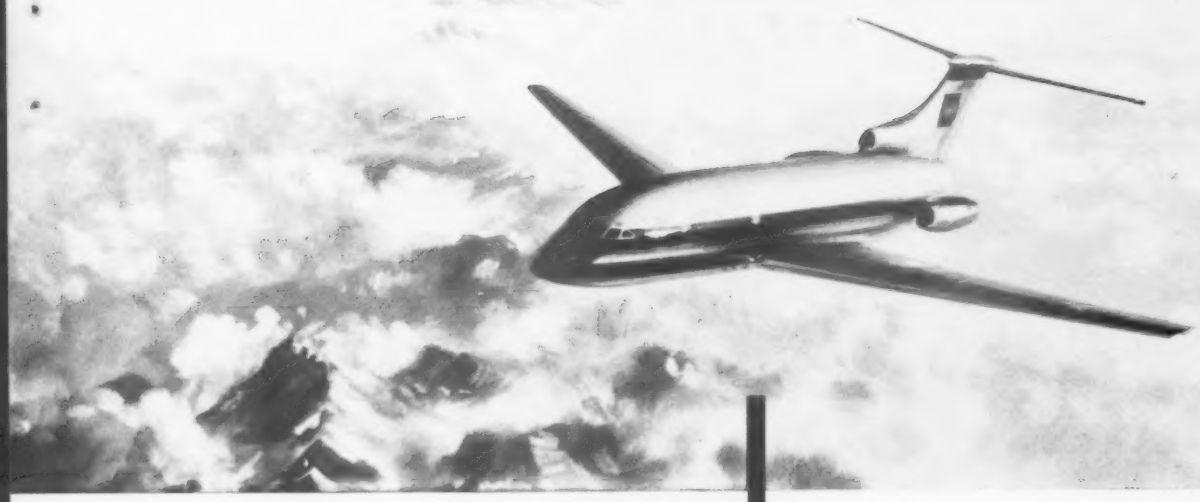

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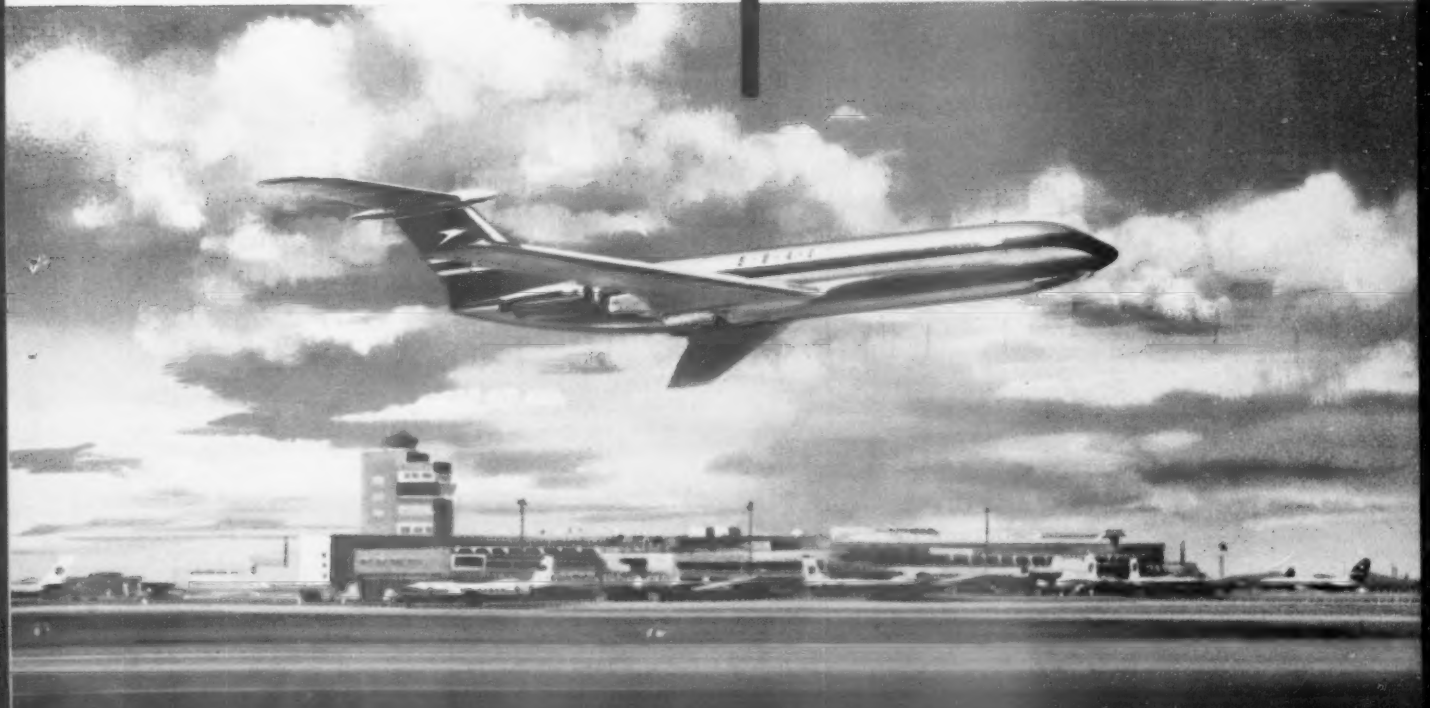

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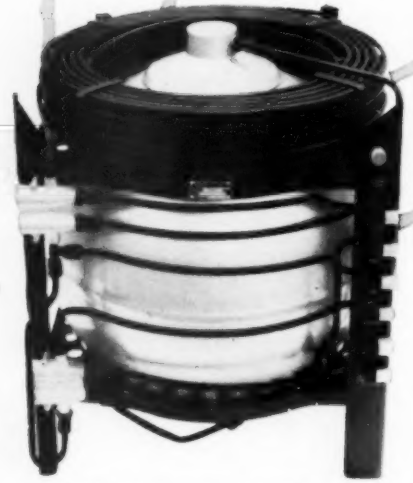

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The BRITISH AIRCRAFT INDUSTRY

A New Pattern and a New Partnership

After the changes in structure and policy during the past eighteen months, the British aircraft industry has a new pattern and the beginnings of a new relationship with the Government—both of which offer good prospects for the future. In this article, which introduces the annual British Aircraft Industry Supplement, some of the developments of the past twelve months are outlined. On the following pages there are details of the products of the British aircraft, aero-engine, missile and equipment industries.

A YEAR ago, when this special issue last appeared, the British aircraft industry was only just recovering from the initial effects of a series of amalgamations which had resulted in three principal airframe and two principal aero-engine groups. The basic reason for these amalgamations was obvious enough in this very competitive world of aviation, but, nevertheless, the suspicion lingered that there had been a series of shot-gun marriages without any very complete idea of the advantages which might be gained from the unions.

During the intervening twelve months the prospects have gradually been clarifying themselves and the process of integration within the groups has been going fairly smoothly, though it will be some time before this integration can be said to be complete.

It has been realized, too, both inside and outside the aviation industry, that the trend towards bigger groupings is, for better or for worse, a general one in nearly all undertakings. The only real danger for such big groupings—especially in an industry which must necessarily depend to a large extent on Government orders—lies in the possibility that bureaucracy might gain overriding power in important decisions. This prospect is not, perhaps, likely to be a very serious one with the British form of government—but decisions affecting the industry have, in the past, been made simply for political reasons and the danger must be guarded against.

The need for the technical, production and financial strength provided by big groups is especially obvious when considering projects such as the supersonic transport—but strength is almost equally necessary for the development and production of any present-day civil transport, military aircraft, or weapon. The technical effort involved is continually increasing and there can be no reduction in the scale of this effort. Despite the potentially increased efficiency of larger design and production units, the need for technical strength continues to grow month by month. Results accruing from the mergers are already to been seen—the Hawker Siddeley Advanced Study Group is one such example.

During the year the Government's promise of support for worthwhile civil transport projects became a little more clearly defined and, though the detailed arrangements are still being discussed and must vary according to the situation, the broad principle seems to have been accepted. This principle differs from that of earlier arrangements—in which the Government paid (at least in theory) for prototype construction and development and was then repaid a percentage of the value of aircraft sold—in that the Government goes, so to speak, into partnership on terms in which both potentialities and risks are shared. Support of different kinds is to be provided, when required, for selected transport aircraft which have good export sales prospects. Five aircraft have, so far, been mentioned in relation to this partnership—the A.W. 650 Argosy Series 200, the D.H. 121 Trident, the VC10, the Super VC10 and the B.A.C. One-Eleven. Others may well be included in due course—depending on the need or otherwise for such initial assistance and on the available financial strength and confidence of the manufacturer concerned.

The problem of successful transport aircraft development and sales remains much as it has always been since the War. The essential starting point is an adequate home market. So, in theory, the industry is in favour of the licensing of new British airline operators—but with reservations related to

traffic-growth prospects. The two Corporations are, after all, the primary and essential customers.

Military export sales present a different problem. The industry has been very successful in the past, but more recently the Service requirements have tended to be limited to types which, however essential to British strategy, have had little specific interest for other air forces—in particular, for those of NATO—or, in the case of transports, for other prospective operators, military or civil.

The fact remains that British aviation export figures continue to remain at a high level. Those for the first six months of this year are as high as the average for any complete year so far. Many times during the past five years or more the prospects for the years in the future have seemed to be poor, once this or that series of orders had been fulfilled—yet the expected down-turn in exports has not, in the event, occurred.

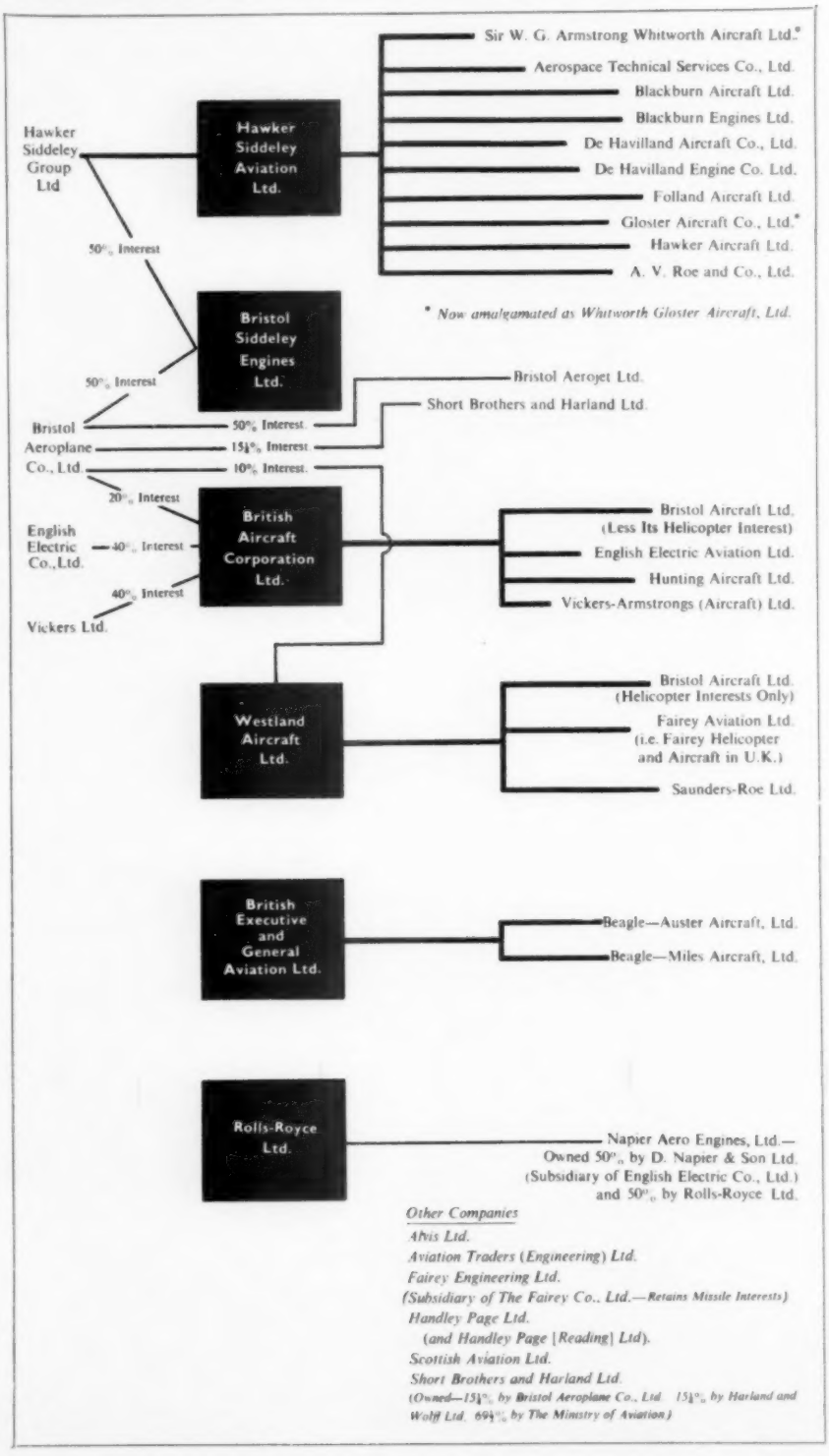
Meanwhile successful efforts are being made to co-operate with European manufacturers and it seems probable that, in fact, any eventual entry by Britain into the Common Market will have relatively little significance for its aviation industry—which may already have made its entry. So far as aircraft and engine sales are concerned, these are not, in any case, much affected by tariff barriers, which, are usually waived for military aircraft and airliners.

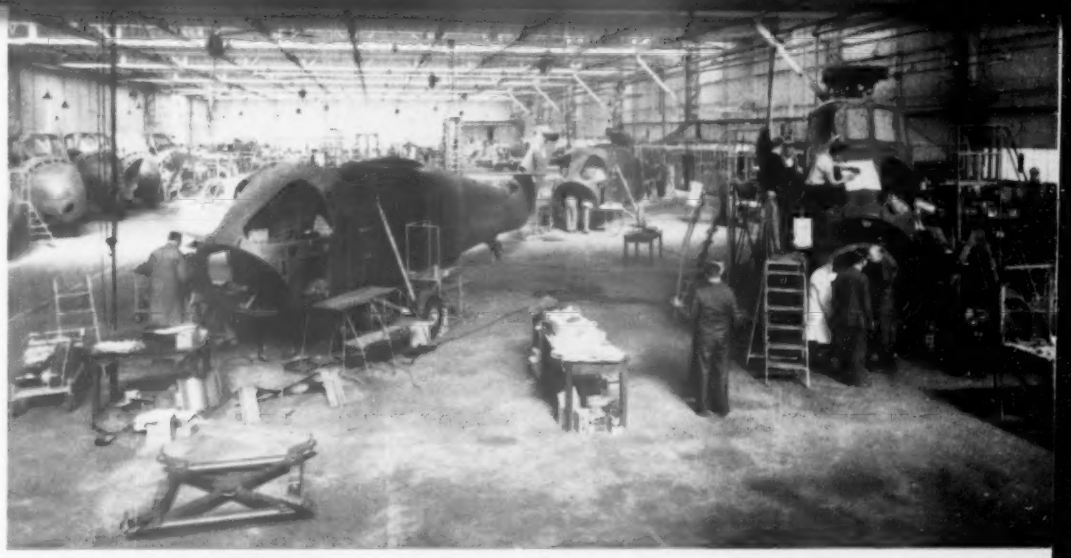
Since the 1960 S.B.A.C. exhibition there have been a number of secondary, but important, changes in the structure of the aircraft industry. British Executive and General Aviation, for instance, has been formed in association with the Pressed Steel Company and with Beagle-Auster Aircraft and Beagle-Miles Aircraft as subsidiaries. The first aircraft from this consortium, Beagle - Auster's Airedale, has already appeared and the vitally important Beagle executive twin is expected at Farnborough next month. Rolls-Royce and D. Napier and Son have formed Napier Aero Engines, in 50-50 partnership to look after all the aero-engine interests of the English Electric subsidiary. In the equipment industry the Dowty Group has taken over Boulton Paul Aircraft.

Among new aircraft which have flown since Farnborough, 1960, are the A.W. 660 military Argosy, the Hawker 1127 VTOL/STOL prototype, the Aviation Traders ATL-98 Carvair and the Beagle-Auster Airedale. The Bristol 188 all-steel supersonic research aircraft may have flown before this issue appears. New aircraft announced as being positively under production development include the B.A.C. One-Eleven turbojet transport, and new variants of the Argosy, the Avro 748 and the Vickers VC10. Additionally to the B-188, aircraft for research work include the Handley Page 115 for narrow-delta research at lower speeds and the Hunting (B.A.C.) 128 for jet-flap experiments.

Without stretching optimistic hopes too far, it can be said that the outlook for the industry is good with its prospects of worthwhile Government support for worthwhile projects; with a reasonable number of new aircraft types under construction; with a healthy aero-engine programme; with the promise of increased European co-operation; and with a fair requirement for missiles and associated weapons.

The primary needs are for the greater encouragement of advanced technologies; for the more rapid finalizing of military operational requirements; and for the administrative means of going ahead much more urgently with prospectively useful aerodynamic and research developments.

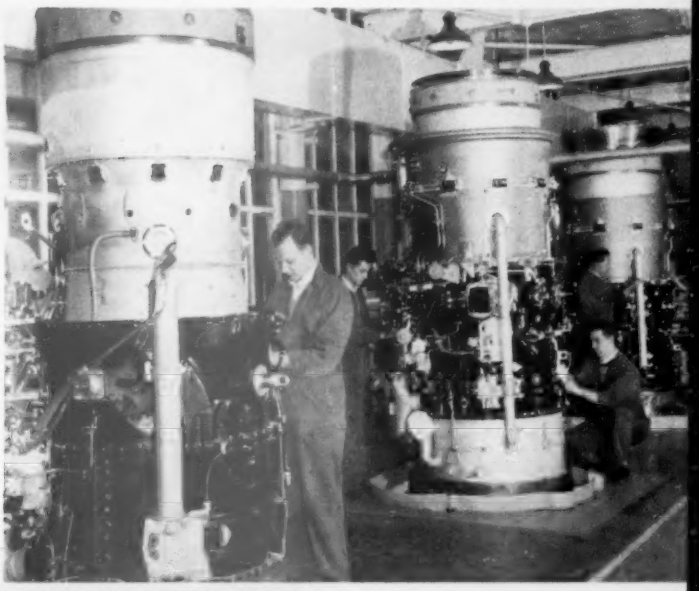

Hawker Siddeley Group Ltd
Hawker Siddeley Aviation Ltd.
Sir W. G. Armstrong Whitworth Aircraft Ltd.*
Aerospace Technical Services Co., Ltd.
Blackburn Aircraft Ltd.
Blackburn Engines Ltd.
De Havilland Aircraft Co., Ltd.
De Havilland Engine Co. Ltd.
Folland Aircraft Ltd.
Gloster Aircraft Co., Ltd.*
Hawker Aircraft Ltd.
A. V. Roe and Co., Ltd.
50% Interest
Bristol Siddeley Engines Ltd.
* Now amalgamated as Whitworth Gloster Aircraft, Ltd.
50% Interest
Bristol Aeroplane Co., Ltd.
Bristol Aerojet Ltd.
50% Interest.
Short Brothers and Harland Ltd.
15½% Interest.
10% Interest.
20% Interest
English Electric Co., Ltd.
40% Interest
40% Interest
Vickers Ltd.
British Aircraft Corporation Ltd.
Bristol Aircraft Ltd. (Less Its Helicopter Interest)
English Electric Aviation Ltd.
Hunting Aircraft Ltd.
Vickers-Armstrongs (Aircraft) Ltd.
Westland Aircraft Ltd.
Bristol Aircraft Ltd. (Helicopter Interests Only)
Fairey Aviation Ltd. (i.e. Fairey Helicopter and Aircraft in U.K.)
Saunders-Roe Ltd.
British Executive and General Aviation Ltd.
Beagle—Auster Aircraft, Ltd.
Beagle—Miles Aircraft, Ltd.
Rolls-Royce Ltd.
Napier Aero Engines, Ltd.—Owned 50% by D. Napier & Son Ltd. (Subsidiary of English Electric Co., Ltd.) and 50% by Rolls-Royce Ltd.
Other Companies
Alvis Ltd.
Aviation Traders (Engineering) Ltd.
Fairey Engineering Ltd.
(Subsidiary of The Fairey Co., Ltd.—Retains Missile Interests)
Handley Page Ltd.
(and Handley Page [Reading] Ltd).
Scottish Aviation Ltd.
Short Brothers and Harland Ltd.
(Owned—15½% by Bristol Aeroplane Co., Ltd. 15½% by Harland and Wolff Ltd. 69% by The Ministry of Aviation)

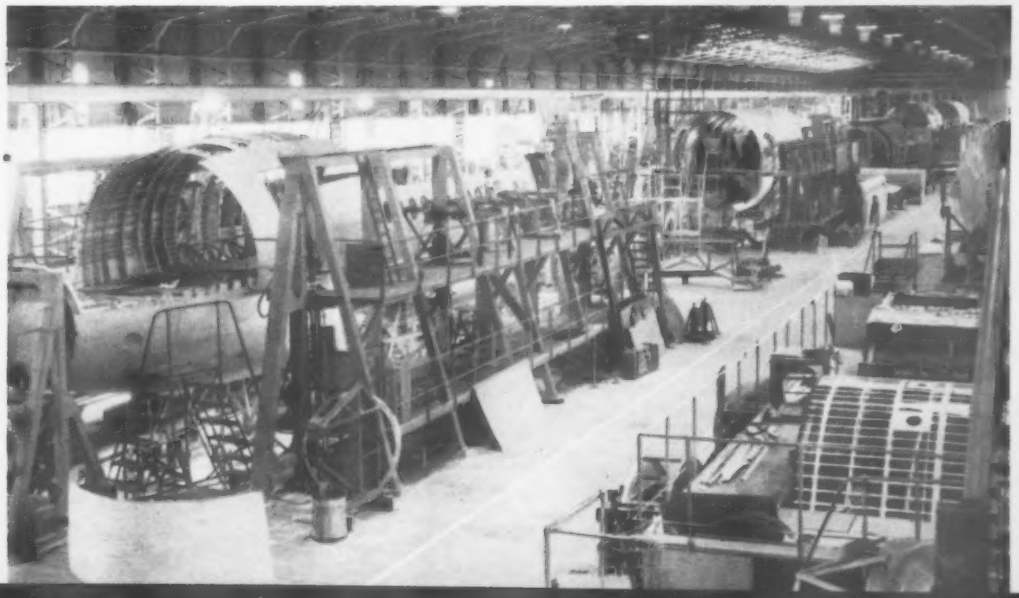


Right, Wessex HAS.1s (foreground) and Whirlwinds being assembled at Westland's Yeovil factory.

Left, part of the Jet Provost line at Hunting Aircraft's Luton factory, where production is at present concentrated on this turbojet trainer. Some of the Luton facilities will soon be taking over part of the B.A.C. One-Eleven production programme.

On the Assembly Lines





Above, the assembly of Rolls-Royce Conway RCo.12s which power the DC-8 Series 40 and Boeing 707-420.

Left, Vickers VC10 fuselage sections in their jigs at Weybridge. In the centre foreground is the forward fuselage of the third aircraft for B.O.A.C.

British Aircraft Industry . . . .

Aircraft, Engines and Missiles

Armstrong Whitworth Aircraft, Ltd.

(Hawker Siddeley Group)

ARMSTRONG WHITWORTH ARGOSY. The success of this twin-boom pressurized freighter has been such that all 10 examples of the initial private venture production batch will have been delivered by the time of Farnborough, or will be undergoing preparation for customer requirements. The civil A.W.650 will therefore probably be represented only by models, although it is hoped that an A.W.660 Argosy Mk. 1 will be available from the R.A.F. to participate in the flying display.

After seven months of operation with Riddle Airlines in the U.S.A., the A.W.650 is achieving utilizations of more than 10 hours per day. By the end of September, each Argosy on Riddle's Logair contract with the U.S.A.F. will be achieving over 13 hours per day. The three A.W.650s ordered in April by B.E.A. will also be delivered by the end of this year, and are due in freighter service by February, 1962.

The prototype A.W.660, XN 814, is the first of 56 Argosy Mk. 1s for R.A.F. Transport Command, and is distinguished by its "crocodile-jaw" rear-loading doors, which open in flight for air dropping freight, and nose radome. Later civil Argosies will be Series 200s.

Aviation Traders, Ltd.

AVIATION TRADERS CARVAIR. Rapid progress has been made with the ATL-98 Carvair prototype since its first flight on Jne. 21, some 25 flights totalling 46 hr. having been completed during the first month. Extensive exploration has been made of the flight envelope, including speed tests up to VDF, the demonstrated dive speed, of 276 m.p.h., I.A.S., and down to VMCA. With its new nose and ramp loading for up to five cars, the Carvair can also carry 25 passengers and should cost no more per hour to operate than the Bristol Freighter, which it will supersede with the Channel Air Bridge.

Ten Carvairs are to be converted from Douglas DC-4s for the ferry service; three time-expired examples of these veteran airliners have been purchased from Resort Airlines for such work to be started. Following completion of C. of A. procedures, Carvair services are planned to start in November, on the Rotterdam route.

A. V. Roe & Co., Ltd.

(Hawker Siddeley Group)

AVRO 748. Two prototypes of this 10,000-lb. payload short/medium-haul rough-field transport have been flying intensively since mid-1960, and, following its certification, the Avro 748 is due to enter service later this year. Route-proving is being done by Skyways Coach-Air, Ltd., and deliveries will also be made to Aerolineas Argentinas, which has nine of these transports on order, to B.K.S. Air Transport (five) and Aden Airways (three Series 2).

Seating up to 48 passengers and their baggage, the Avro 748 Series 1 is powered by two 1,760 e.h.p. Rolls-Royce Dart R.Da.6 turboprops, and is optimized for short stage lengths of 200-400 miles. With the same structure and internal layout, the Avro 748/2 has R.Da.7s of 2,105 e.h.p., which will enable operators from critical airfields to lift maximum payloads under extreme conditions. Cruising at 260 knots at 25,000 ft., stages of up to 850 n.m. are possible while carrying full payload plus adequate reserves. Avro 748s are also being assembled at Kanpur for the Indian Air Force.

Extensive initial flight trials have been conducted with the Aviation Traders ATL-98 Carvair, which is due in service later this year.

Conversion of the former Army Auster A.O.P.6 to civil standards has resulted in production of the low-cost three-seat Terrier.

AVRO VULCAN. Bomber Command operates several squadrons of Vulcan B.1 and B.2 strategic nuclear weapon carriers, the striking range and power of which are soon to be increased by the provision of air-launched guided missiles.

First will be the Avro Blue Steel stand-off bomb, a Stentor-powered tail-first vehicle controlled by the "twist-and-steer" principle in which turning is initiated by the use of aileron and maintained by increasing lift. Extensive tests at Woomera and elsewhere have been completed with Blue Steel, which is due for service with the Vulcan B.2 and Victor B.2 in the near future.

The Vulcan 2 will later be equipped to carry the Douglas GAM-87A Skybolt air-launched ballistic missile which is undergoing a massive development programme in the U.S. A Vulcan has already been sent to the U.S. for engineering studies to permit the carriage of two 38-ft. 2-megaton Skybolts beneath its delta wings, together with the complex launch and guidance equipment inside the fuselage.

British Executive and General Aviation, Ltd.

BEAGLE-AUSTER AIREDALE. Four prototypes of this four-seat tourer in the modern manner had flown by the beginning of August, three with the standard 180 b.h.p. Lycoming O-360 flat-four engine, and the fourth with the 175 b.h.p. Continental GO-300 flat-six. The Airedale will eventually be available with this engine, when Rolls-Royce built, and will be flown in this form at Farnborough. Examples of the initial Lycoming version will be shown statically.

The Airedale has an exceptionally good speed range, as will be seen at Farnborough, and a short take-off and landing performance conferred by its variable-pitch airscrew and slotted flaps. The v.p. propeller and many other items normally regarded as extras are supplied in standard form, for which the U.K. price is only £4,750. Despite its obvious relationship to earlier Austers, the extent of revision in the Airedale design is indicated by the fact that it has involved well over 100,000 man-hours.

BEAGLE-AUSTER A.O.P. MK. 11. Modifications to give STOL performance to the well-proven Auster A.O.P.9 of the Army Air Corps have resulted as a first step in the installation of the 260 b.h.p. Continental IO-470 flat-six engine (eventually to be built by Rolls-Royce) in place of the

standard 180 b.h.p. Blackburn Bombardier. In its revised form, with the exhaust-ejector Continental powerplant, the Auster Mk. 11 made its initial flight a week or two ago, and immediately showed the benefit from the extra power. Apart from its STOL characteristics, the change was accompanied by an increase in cruising speed from 110 to 148 m.p.h.

A projected further development, the Auster A.O.P.12, introduces full-span slats, slotted flaps and drooping ailerons, as well as a revised rear fuselage and swept fin, for even more advanced STOL performance. A production contract has been placed for the Auster 11 by the Army Air Corps.

BEAGLE-AUSTER TERRIER. One of the cheapest three-seater light planes available anywhere in the World, the A.61 Terrier is based on the original Auster A.O.P.6, but incorporates many new developments and improvements. The ailerons have been redesigned to lighten their control forces by the addition of tabs. The interior has been refurnished and generally cleaned up. Instrument panel layout has been revised and greatly improved, and soundproofing qualities bettered by the addition of a long exhaust pipe and silencer. With its well-tried Gipsy Major 10 engine, the Terrier cruises reasonably fast and economically, and is unusual among modern touring aeroplanes in being fully aerobatic. Price, in new condition, is £1,995.

BEAGLE-MASEFIELD B.206. Making its initial public appearance at Farnborough, the Beagle B.206 was, at the time of going to press with this page, about to make its first flight at Shoreham. Although backed by a prolonged market evaluation, which framed its specification, the B.206 was designed and built in the extraordinarily short time of nine months and a rapid flight-test programme is planned.

The prototype is powered by two 260 b.h.p. Continental IO-470-D engines, which will eventually be Rolls-Royce built, and offers accommodation for five people, plus flight toilet. Alternative seating arrangements are planned for up to seven persons, who may be carried at cruising speeds of up to 200 knots. With up to 200 Imp. gal. of fuel in its integral wing tanks, the B.206 has an exceptional range, and can fly for 1,550 n.m. on 145 gal. at 182 knots. Its features also include double-slotted flaps, hot-air de-icing, retractable air-stairs and full airline instrumentation. Price is expected to be less than £30,000.

BEAGLE-MILES M.117. This two/three-seater bears the same relationship to the M.218 as did the Messenger to the Gemini, and is powered by a single Rolls-Royce Continental O-200-A engine of 100 b.h.p. driving a Dowty-Rotol McCauley metal airscrew. Of all-metal construction, incorporating a number of glass-fibre components, the M.117 has a fixed tricycle undercarriage and is furnished and equipped to a very high standard. Normal continuous cruise speed is 115 m.p.h., and the U.K. price in the region of £2,000. First flight date is planned for next summer.

BEAGLE-MILES M.218. Carrying on where the popular Gemini left off, this four-seat light twin is being built at Shoreham, and is due to fly in the summer of 1962. It is powered by two 100 b.h.p. Rolls-Royce Continental O-200A engines driving Dowty-Rotol McCauley feathering airscrews, and has a steerable nosewheel undercarriage. Design cruising speed is 150 m.p.h. and the full-load range 645 miles. A furnished mock-up of the roomy cabin of the M.218, which also has generous baggage capacity, is being shown on the Beagle stand at Farnborough. U.K. price is envisaged at around £5,000.

BEAGLE-WALLIS AUTOGYRO. One of the many activities of the BEAGLE Group is the development of a one-man autogyro for civil and military use, in conjunction with Wg. Cdr. K. Wallis, who has had a great deal of experience with the original Bensen gyro-copter. A photograph of the Beagle-Wallis prototype is to be displayed on the Beagle stand.

Blackburn Aircraft, Ltd.

(*Hawker Siddeley Group*)

BLACKBURN BUCCANEER. This high subsonic speed low-altitude nuclear strike aircraft entered initial service with the Royal Navy late last year when No. 700 "Z" Squadron was formed at Lossiemouth for operational capability trials. The Buccaneer successfully completed its deck-handling test programme some time ago, and has proved the efficacy of its blown wing, flap and tail system in reducing approach speeds and improving controllability.

Currently powered by two 7,100 lb. D.H. Gyron Junior 101 (DGJ 2) turbojets, the Buccaneer 1 is being further developed to take the more powerful and economical Rolls-Royce Spey turbofans. The Buccaneer 2 may be expected to have an even more potent performance over extensive ranges, which may be further increased by flight refuelling. Successful trials with such equipment have already been completed with the Buccaneer 1.

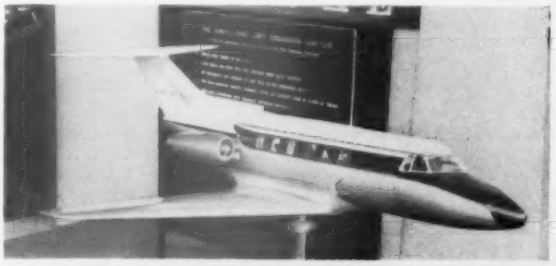
Bristol Aircraft, Ltd.

(*B.A.C. Group*)

BRISTOL 188. First flight of this all-steel hypersonic research aircraft is imminent as we go to press before Farnborough, where it is hoped that the Bristol 188 will appear. Powered by two 14,000 lb. D.H. Gyron Junior DGJ 10R turbojets, the Bristol 188 was designed for sustained flight at Mach numbers of well over 2.5 to facilitate study of thermal problems on airframe, engines and components. New fabrication techniques had to be evolved for the Firth Vickers F.V.520 stainless-steel structure of the Bristol 188, which has a maximum service temperature of 500° C. The Bristol 188 has wings of 4% t/c ratio, and the nacelle mounting of its turbojets is designed to simplify the installation of various powerplants.

British Aircraft Corporation, Ltd.

BRITISH AIRCRAFT CORPORATION 111. Following the cancellation of the Vickers VC11 project, and the taking over by B.A.C. of the development of the Hunting 107, some of the experience gained with both programmes has been used to produce the B.A.C. One-Eleven. A short-haul jet, powered by two 9,850-lb. s.t. rear-mounted Rolls-Royce Speys, the B.A.C. 111 is intended to carry up to 69 tourist passengers over stage lengths of 450 miles, or normally 57



Variety in de Havilland design is illustrated by the D.H. 125 Jet Dragon (top) executive transport, due to fly next year, the Sea Vixen all-weather strike fighter (above), and the time-honoured Dove, seen in its rôle of corporate transport (left).

British Aircraft Industry . . . .

mixed-class passengers over 800 miles at 500 m.p.h. cruising speeds.

First flight of the prototype is planned for mid-1963, with deliveries scheduled for a year later. B.U.A. has already ordered 10 One-Elevens, with an option on a further five, while letters of intent for 11 have been received from Ozark and Frontier Air Lines. Work is also continuing with the B.A.C. 107, which in some respects is a scaled-down version of the 111, with two 7,350-lb. Bristol-Siddeley B.S.75s, and a gross weight of 48,500 lb. compared with 66,000 lb. for the larger aircraft. Passenger capacity of the B.A.C. 107 will be up to 59, carried over stage lengths of about 500 miles.

The de Havilland Aircraft Co., Ltd.
(*Hawker Siddeley Group*)

DE HAVILLAND COMET. As the World's first jet airliner, the Comet has an unrivalled background of operating experience, and is in service with eight international airlines as well as Transport Command of the R.A.F. Three versions of the civil Comet are currently available: the inter-Continental Mk. 4, designed to carry 60-81 passengers on stages of up to 3,000 st. miles, the Continental Comet 4B, with clipped wings and an extended fuselage seating up to 100 passengers over short and medium ranges, and the high-capacity Comet 4C with range capabilities only slightly less than those of the basic Mk. 4. All are powered by the 10,500-lb. Avon 525B turbojet, which has achieved an overhaul life of 2,600 hr. No. 216 Sqn., Transport Command, has been operating 10 Comet C.2s for several years, and five 4Cs are on order for this Command.

DE HAVILLAND HERON. About 150 Herons have so far been delivered to more than 30 countries, for airline or executive use. Seating varies between 14-17 for commercial operations, and six-eight in corporate service. The Queen's Flight, which has operated three Heron 2s for several years, was recently augmented by a fourth aircraft of this type.

DE HAVILLAND DOVE. Production of this well-established executive transport and feederliner continues with the Mks. 7 and 8, which have the 400 b.h.p. D.H. Gipsy Queen 70 Mk. 3 engines, exhaust augmentors and Heron-type cockpit canopies. The Series 8 has been specially developed for the American executive market, where it is known as the Custom 800. Since it first appeared, late last year, it has been modified by the addition of larger oil coolers above the engine nacelles.

DE HAVILLAND JET DRAGON. Work is continuing at high priority on the prototype of this six-eight seat executive jet, which is powered by two Bristol Siddeley Viper 20 engines, each of 3,000 lb. thrust, mounted on the sides of the aft fuselage. The Jet Dragon is designed to combine the operating costs and short-field performance of the Dove with a 500 m.p.h. cruising speed over stages of around 1,500 miles. Several British and foreign industrial companies have already shown a firm interest in the Jet Dragon, which is due to make its first flight early in 1962. An initial series of 30 aircraft are being laid down as a private venture.

DE HAVILLAND SEA VIXEN. Having entered squadron service with the Fleet Air Arm in July, 1959, the Sea Vixen equips several all-weather fighter units embarked on aircraft carriers of the Royal Navy. Primary armament of the Sea Vixen is the D.H. Firestreak AAM, four of which are carried on underwing pylons, for use in conjunction with the advanced A.I. radar. Additional armament comprises 28 2 in. air-to-air rockets in two retractable Microcell glass-fibre packs beneath the nose, and a further 96 folding-fin rockets in four Microcell packs may be carried as an alternative weapon load to the Firestreaks. These may also be replaced by a variety of other stores, including a self-contained "buddy" pack for flight-refuelling other Sea Vixens or naval aircraft. A probe may be mounted forward of the port boom, from the wing leading-edge.

DE HAVILLAND TRIDENT. Designed for operation on the World's short-haul routes and as a second-generation jet for British European Airways, the Trident takes the rear-engine and clean-wing concept a stage further with its ability to carry 80-100 passengers over distances of up to 1,200 miles at more than 600 m.p.h. Its most economical speed is very little less, and is claimed to be faster than that of any other commercial jet aircraft. Power is supplied by three rear-mounted Rolls-Royce Spey by-pass turbofans, each delivering 10,400 lb. thrust. The clean wing permits the use of full-span lift augmentors on leading and trailing edges, so that, with a maximum payload, the runway requirements are less than 6,000 ft. Slats and flaps also contribute to docile low-speed handling, and facilitate the installation of auto-flare landing equipment for all-weather operation. B.E.A. is to have 24 Tridents from late 1963, and has also taken an option on a further 12. The first Trident was rolled out at Hatfield on Aug. 4.

English Electric Aviation, Ltd.
(*B.A.C. Group*)

ENGLISH ELECTRIC CANBERRA. One of the longest-lived designs in operational R.A.F. service, the Canberra functions in many tactical rôles, and is still in production in its high-altitude photographic-reconnaissance version, the P.R.9. With extended wings and Avon 206 turbojets, the Canberra P.R.9 is built by Short Bros. and Harland, Ltd., at Belfast. It equips some Bomber Command P.R. squadrons which also operate the older Canberra P.R.7s. Bomber variants include the B. and B.(I)6, and the B.(I)8, which have recently been developed into new tactical and rocket interdictor types as the Canberra B.15 and B.16.

For service with R.A.F. squadrons overseas, the B.15 is similar to the standard three-seat B.6 except for the addition of UHF and HF radio to its VHF, a Decca roller-map fed from the Doppler nav. system and underwing pylons for two 1,000 lb. bombs or Microcell rocket pods (each 37 x 2 in. RPs) in addition to the normal internal stowage of six 1,000 lb. bombs or nuclear weapons. Nose, rear fuselage and wing cameras are also carried for reconnaissance by the Canberra B.15, which is similar to the B.16 except for certain radar equipment carried by the latter. Other variants in service include the T.4 crew trainer and the T.11 radar trainer, plus the U.10 pilotless target.

ENGLISH ELECTRIC LIGHTNING. Three squadrons of Lightning F.1A interceptors are now fully operational with R.A.F. Fighter Command, and production of that mark has been completed. It is being followed on the Samlesbury assembly line by Lightning F.2s and F.3s, together with a few Mk. 4 trainers, the more advanced operational aircraft incorporating 300-series Rolls-Royce Avons, OR.946 integrated flight instrument system, and provision for carrying Red Top or other improved stores.

Standard armament of current operational Lightnings is a brace of D.H. Firestreak AAMs, either two or four 30 mm. ADEN cannon, and 48 2-in. folding-fin aircraft rockets. With the fast climb and acceleration conferred by its afterburning Avons, powerful armament and excellent manœuvrability, the Lightning is among the most potent single-seat twin-jet fighters in service.

Folland Aircraft, Ltd.
(*Hawker Siddeley Group*)

FOLLAND GNAT TRAINER. Developed from the Mk. 1 lightweight fighter, the Gnat Trainer is now in quantity production at the Hamble works of Folland Aircraft. The original order for 44 Gnat Trainers was recently expanded by a "further substantial number." The Gnat is due to

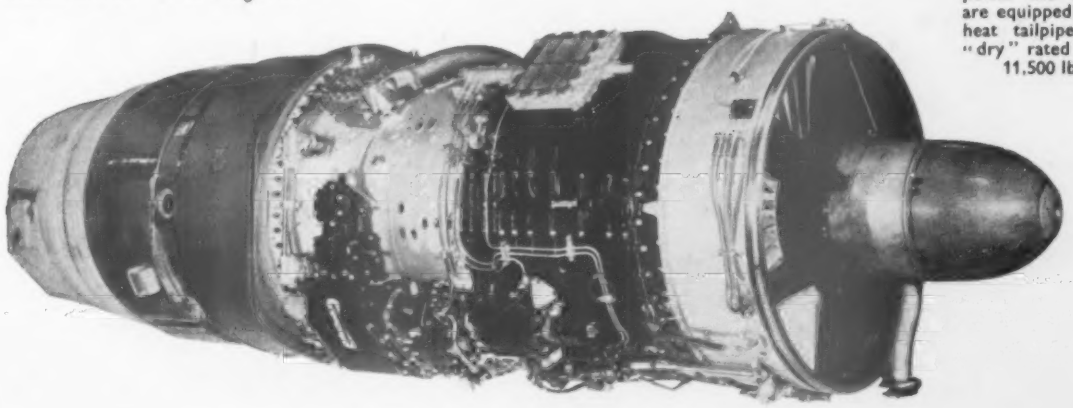
(*Continued on page 244*)

Newest de Havilland product and scheduled to make its first flight before the end of the year is the Trident, for B.E.A.

Now in squadron service with the Royal Air Force, the Lightning is in the Mach 2 category; it is armed with de Havilland Firestreak air-to-air heat-seeking guided missiles and has two Aden cannon as fixed armament. Later versions with more powerful Avon turbojets are now in production.

English Electric Lightning F.1A

Two 14,430-lb.s.t. Rolls-Royce Avon RA.24R turbojets

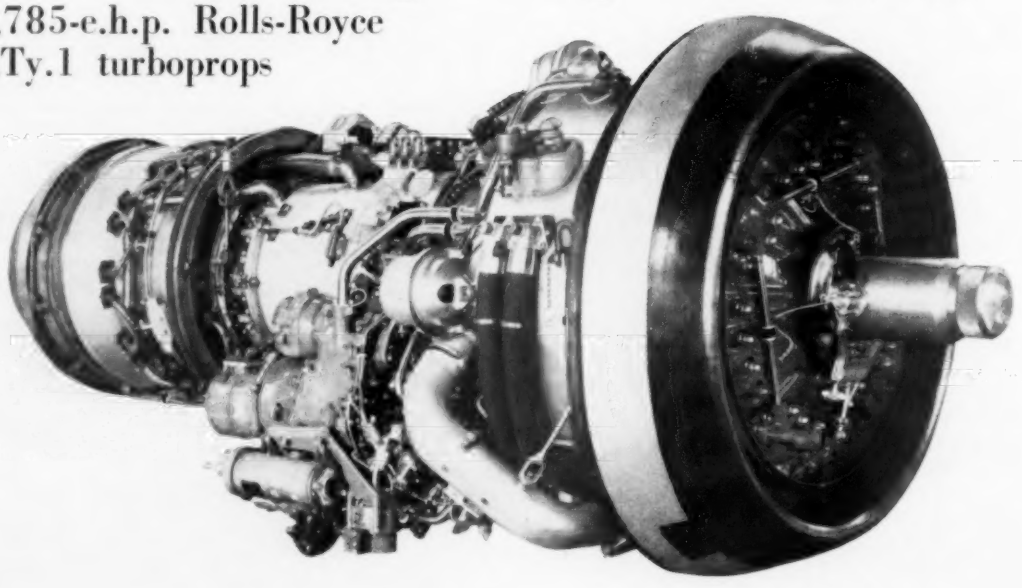


Mounted one above the other, and staggered fore and aft, the two Avons which power the Lightning are equipped with reheat tailpipes; their "dry" rated thrust is 11,500 lb.s.t.

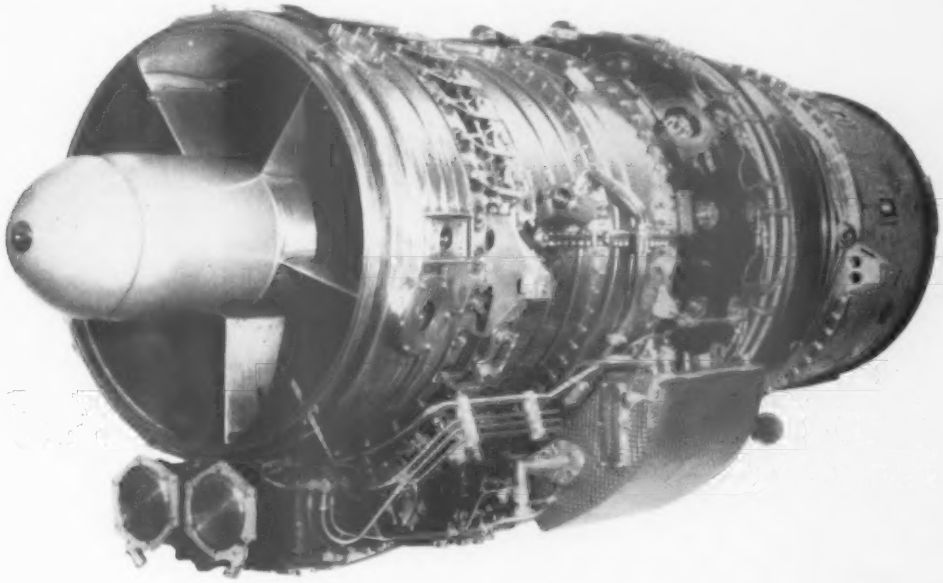
In service with British European Airways and Trans-Canada Airlines, the Vanguard is seen here on the apron at Heathrow. Forty-three have been ordered by the two airlines—six 951s and 14 953s by B.E.A. and 23 952s by T.C.A.

Vickers-Armstrongs Vanguard

Four 4,785-e.h.p. Rolls-Royce Tyne RTy.1 turboprops



The version of the Tyne in B.E.A.'s Vanguards is the Mk. 506 with a take-off power of 4,785 e.h.p. T.C.A. aircraft have the RTy.11 Mk. 512 (shown here) which gives an equivalent take-off power of 5,325. The Tyne is a two-spool engine.



The Gyron Junior installed in the Type 188 is basically similar to the earlier version of the engine but has been specially modified for supersonic operation; without reheat its thrust is 10,000 lb.

Bristol Type 188

Two 14,000-lb.s.t. de Havilland Gyron Junior DGJ.10 turbojets

A research aircraft intended specifically for studying supersonic problems such as kinetic heating, and those associated with powerplant, structural and systems design, the Bristol 188 completed its preliminary engine runs in April. It is a single seater constructed largely of stainless steel.

Standard all-weather fighter in R.A.F. service is the Gloster Javelin FAW.9, seen here in the colours of No. 25 Squadron.

British Aircraft Industry . . . .

(*Continued from page 240*)

enter service in 1962 as the standard R.A.F. advanced instructional type. It can also be converted for armament training or fighter operations by fitting up to 1,000 lb. of external bombs, rockets or guided weapons. Two 30-mm. cannon or four 12.7-mm. machine-guns can also be mounted in special slipper tank packs.

With a transonic performance, and a maximum level speed of M=0.95, coupled with docile handling characteristics, the Gnat is an efficient means of transition from the basic trainer to operational fighters or bombers. Work is continuing on fighter and trainer developments with a level flight performance of M=2.

Gloster Aircraft Co., Ltd.

(*Hawker Siddeley Group*)

GLOSTER JAVELIN. Many marks of the Javelin two-seat all-weather fighter are in service with the R.A.F. in the U.K., Germany and farther afield, the most advanced being the FAW. Mks. 8 and 9. Both have reheat for their B-S Sapphire turbojets, and are armed with two wing-mounted 30-mm. ADEN cannon, plus four underwing Firestreak AAMs. The Mk. 8 has U.S. radar and a Sperry autopilot, while the Mk. 9 uses British AI equipment and has provision for flight refuelling.

A few Javelin T. Mk. 3s are also in service for operational conversion and crew training, equipped with dual controls but having no nose radar. Production and conversion of Javelins is now complete, but a modified aircraft equipped with D.H. Gyron Junior D.G.J.10 engines for test purposes will be shown at Farnborough.

Large R.A.F. orders have now been placed for the Folland Gnat Trainer, which is to replace the Vampire T.11 at advanced F.T.S.

Handley Page, Ltd.

HANDLEY PAGE HERALD. The first production example of this 44/56-passenger twin-turboprop transport has already entered service with Jersey Airlines (which has ordered six of the developed Srs. 200 variant) and later this year Heralds will begin operations in Canada with Maritime Central Airways and Nordair, Ltd. Three standard 44-seat Heralds have been ordered by M.o.A. for B.E.A., which will operate them from early 1962 onwards on its Scottish routes. Since its initial flying programme, which contributed to the 200,000 miles of flying in 58 countries achieved during demonstration tours, the Herald prototype has been modified to 200 series standard by the addition of a 42-in. front fuselage extension. With the use of a compact-type seat, this increases maximum accommodation to 50 passengers, a large buffet, radio equipment, toilet and 340 cu. ft. of baggage space, or 56 passengers with no buffet and less luggage.

HANDLEY PAGE H.P. 115. Few details are yet available of this small single-seat Viper-powered research aircraft which has been built to investigate the slow-speed handling characteristics of the low aspect-ratio delta-wing. This wing configuration holds a great deal of promise for the supersonic airliner, and an extensive test programme into the characteristics of the slim delta has been planned.

HANDLEY PAGE VICTOR. With the Vulcan, the Victor is the main medium for the expression of the British nuclear deterrent and, according to the A.O.C. Bomber Command, is "the best medium bomber in the World." Both Victor B.1s and B.2s are in service on strategic bombing and reconnaissance duties, to which they will soon add that of missile carrying. The Victor B.2 will be equipped to launch Blue Steel, and is capable of carrying ballistic missiles. Instead of the 11,000 lb. s.t. B-S Sapphires of the Victor 1, the B.2 has four 17,250 lb. s.t. Rolls-Royce Conway RCo 11 turbojets.

Hawker Aircraft, Ltd.

(*Hawker Siddeley Group*)

HAWKER HUNTER. Many day fighter/ground attack squadrons of the R.A.F. continue to operate the versatile Hunter. The older F. Mk. 6s are being converted and strengthened to FGA. 9 standards, with more powerful Avon 207 turbojets, wing stiffening and tail parachute stowage for tropical ground attack operations. Squadrons of Hunter 9s from Aden and Nairobi were involved in the recent Kuwait reinforcement moves.

With a modified nose containing one forward-facing and two oblique cameras, although otherwise similar to the FGA. 9, Hunter FR. Mk. 10s have recently replaced the Supermarine Swift in two tactical reconnaissance squadrons in Germany, and will also equip other overseas units. Hunter T.7s and T.8s continue to be the mainstay of R.A.F. and Royal Naval Operational Conversion Units.

HAWKER P.1127. It is almost a year since the first P.1127 subsonic VTOL tactical strike aircraft began its flying trials, on Oct. 21, 1960, during which time the test programme has been progressively down from level flight and up from the hover to achieve the critical point of transition between the two regimes. Transition is due any day now, and depending on its achievement is the appearance of the P.1127 at Farnborough.

The prototype P.1127, which is not strictly a research project since it has an armament capability from underwing pick-up points, set out to prove the practicability of the swivelling nozzle concept employed by its BS 53 Pegasus engine. This seems indisputably demonstrated, while the aircraft itself has displayed a remarkable degree of stability in the hover regime, even without artificial aids. For the full performance of the P.1127 to be exploited, a more powerful Pegasus variant is needed, but this is foreseen in the NATO interest displayed in this significant technological development.

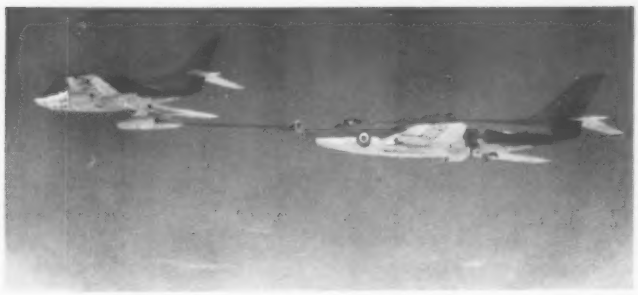
Hunting Aircraft, Ltd.

(*B.A.C. Group*)

HUNTING JET PROVOST. Apart from being the standard basic trainer for the R.A.F., the Jet Provost also equips the air forces of several overseas countries. Ceylon was the first to receive the Jet Provost T.51, as the armed export variant is designated, 12 being initially ordered for the R.Cy.A.F. Since then, orders have been placed by the Kuwait Government for six Jet Provosts and by the Sudanese Air Force.

The R.A.F. operates the Jet Provost Mk. 3, powered by

Production of the L.A.C. Prospector with the 295 b.h.p. Lycoming engine is continuing at Salmesbury for utility and agricultural use.



Supermarine Scimitars of the Royal Navy are seen here during a flight refuelling exercise using a "buddy" pack.

a 1,750 lb. B.S. Viper 102 (ASV 8), and fitted with two Martin-Baker ejection seats, but a small series of T. Mk. 4s, with Viper 201 series engines, has been ordered for evaluation.

HUNTING ER.189D. A single-seat research aircraft, with blowa full-span double-slotted flaps and powered by a single Bristol Siddeley Orpheus turbojet, is nearing completion at Luton and is due to fly later this year. The Hunting ER.189D or H.126 is designed to prove the possibility of diverting almost the entire propulsive thrust of a turbojet unit over mainplanes and control surfaces to give very high lift coefficients and exceptional low-speed performance and control. Some engine thrust is used for balancing purposes, and to augment control and stability at minimum speeds. The ER.189D has a fixed nosewheel undercarriage and a high-set tailplane.

Napier's little Agri-copter has been built to test the practicability of the single-seat autogiro for agricultural use.

Lancashire Aircraft Co., Ltd.

LANCASHIRE PROSPECTOR. Production of this six-seat general-purpose utility aircraft continues at Samlesbury to order, deliveries having been few in recent months. Standard powerplant is now the 295 b.h.p. Lycoming GO-480-G1A6 engine, the experimental Cheetah-powered Prospector II having been dropped. The Prospector has proved particularly suitable for crop-spraying, having a combined glass-fibre hopper and spray tank of 170 Imp. gal. capacity.

D. Napier & Son, Ltd.

NAPIER AGRI-COPTER. Developed from the Bensen B8-MEJ "hobby" gyro-copter, this Napier project is an attempt to produce a practical, simple and relatively low-cost vehicle for agricultural operations on small farms. Powered by a 68 b.h.p. McCulloch two-stroke four-cylinder engine, the Agri-Copter is designed for an agricultural payload of 100 lb., and is hoped to halve the cost of fixed-wing spraying sorties. Its principal mechanical departure from the original Bensen specification is the incorporation of a spin-up gear for the rotor, to shorten the take-off time and run.

Scottish Aviation, Ltd.

SCOTTISH AVIATION TWIN PIONEER. Over 90 Twin Pioneer STOL transports have now been delivered or are on order, and are in operation in many countries and undeveloped areas throughout the World. In the past year, orders have been received from Malaya, Dutch New Guinea, Sierra Leone, Iraq and Australia. All current Twin Pioneers are Series 3, powered by two 640 b.h.p. Alvis Leonides 531/8B engines.

Short Bros. and Harland, Ltd.

SHORT BELFAST. Work is well advanced on the first of 10 Short SC.5 Belfast freighters for the R.A.F., and the prototype of this 218,000 lb. four-Tyne transport should fly next year. Development of civil versions is also continuing, the latest being the SC.5/31 swing-nose variant for the North Atlantic route, on which payloads of up to 100,000 lb. could be carried. An 11 ft. section of the two-deck, swing-nose SC.5/31 is being shown at Farnborough, with typical freight/cargo arrangements on the lower deck, and sections of three-abreast seating on the upper.

A Short-designed fully automatic freight terminal has been developed in conjunction with the Belfast, which with the help of roller conveyors can thus be loaded or unloaded in about 30 minutes.

SHORT SC.1. Details of this five-R.B.108-engined "flat-riser" VTOL research aircraft are now well known, and it has demonstrated its remarkably uneventful transition from and to hovering flight at Farnborough last year and during the recent Paris Aero Show. This year at Farnborough it will be flown by Denis Tayler, Short's chief test pilot. Experience gained with the S.C.1 has been used by Short Bros. in a number of projects for VTOL types, ranging from high-speed military fighters to supersonic airliners.

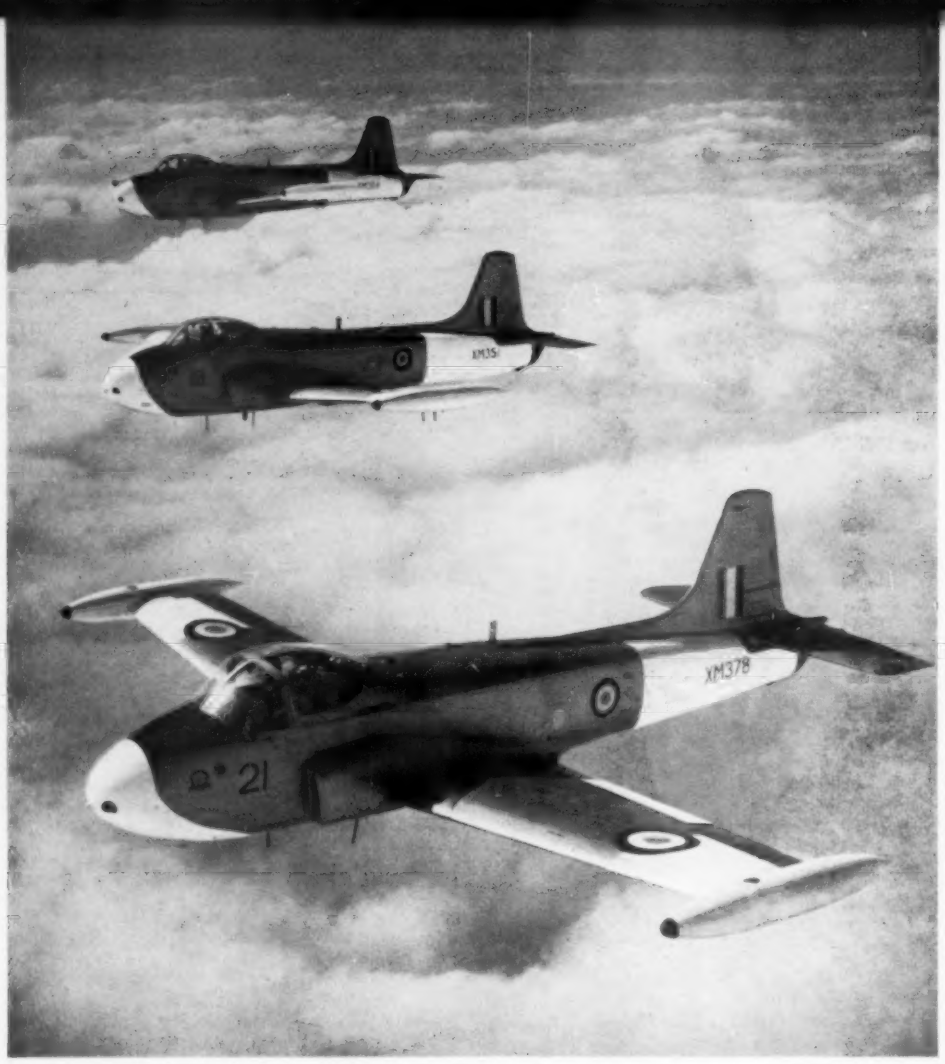
SHORT SKYVAN. Construction of the prototype SC.7 Skyvan, which will be powered by two 390 b.h.p. Continental GTSIO-520 flat-six geared and turbo-supercharged injection engines, is continuing after a slight delay because of company commitments with the Belfast programme. Completion of this interesting design, which incorporates a number of novel structural features, is scheduled for early 1962, and a Mk. 2 version may follow with two Turboméca Astazou II turboprops. With a 3,000-lb. payload, the Skyvan is intended for semi-STOL operations in undeveloped areas, and will provide accommodation for up to 15 passengers.

Vickers-Armstrongs (Aircraft), Ltd. (*B.A.C. Group*)

SUPERMARINE SCIMITAR. As the Fleet Air Arm's standard single-seat strike fighter, the Scimitar equips at least two operational squadrons as well as a second-line training unit. Apart from its conventional weapons, which include four 30 mm. Aden cannon, plus underwing H.E. bombs, rockets or rocket pods, the Scimitar also has a nuclear capability in the tactical rôle, being fitted with LABS equipment for low-altitude delivery. A recent development has been the adaptation of the Scimitar to carry Sidewinder AAMs, with infra-red homing, for day fighter interception duties. For tactical reconnaissance, camera equipment may be carried in an interchangeable nose fairing.

(*Continued on page 248*)

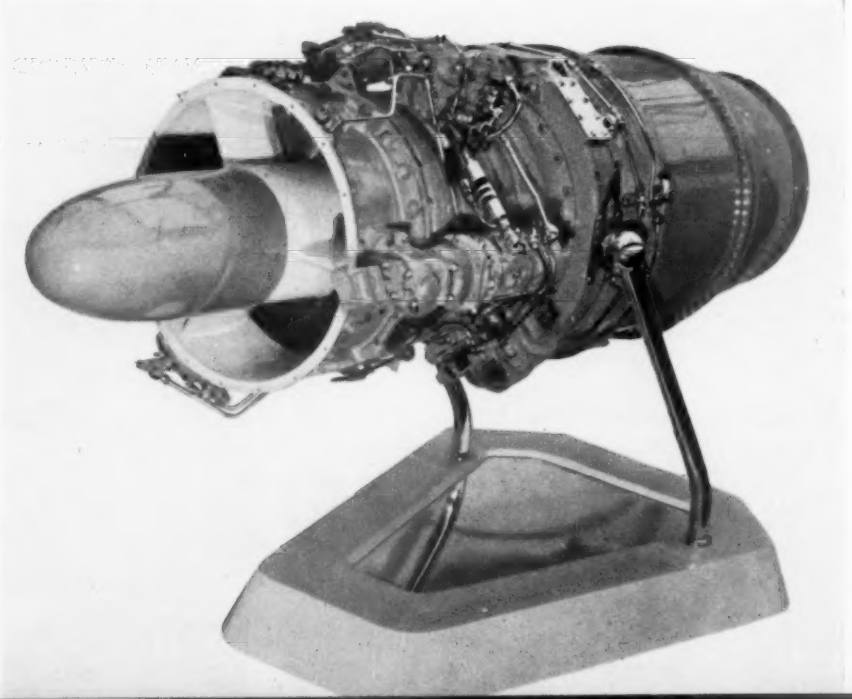
Seen below at the 1961 Paris Salon display, the Short SC.1 is to repeat its demonstration of jet VTOL during this year's S.B.A.C. Show.



Standard basic jet trainer for the Royal Air Force, the Hunting Jet Provost is a versatile aircraft with side-by-side seating that has also been adopted by the air forces of other countries. It is available for general-purpose use as well as for training.

Hunting Jet Provost T.3

One 1,750-lb.s.t. Bristol Siddeley Viper ASV.8 turbojet



Originally designed as a short-life engine for target aircraft the Viper has been developed over the years into a first-class turbojet powerplant for orthodox aircraft. The version shown here—the ASV.11—powers the later Jet Provost T.Mk.4 and delivers 2,500 lb.s.t.

Armstrong Whitworth Argosy C.1

Developed from the civil Argosy transport, the A.W. 660 Argosy C.1 is in production for Royal Air Force Transport Command; 56 have been ordered. This photograph is of the development prototype on its first flight.

Four 2,870-e.h.p. Rolls-Royce Dart RDa.8 turboprops

A special feature of the military Argosy is its "beaver-tail" rear loading doors through which heavy equipment can be driven; there is no nose door in this version but large paratroop side doors have been incorporated.

Current products of the Westland stable include (top, left) the Gannet AEW.3, the Nimbus-powered Wasp for the Army Air Corps (top, right), and (above) the Gnome-Whirlwind 10 for the R.A.F.

British Aircraft Industry . . . .

(*Continued from page 245*)

VICKERS VALIANT. Although replaced in some Bomber Command squadrons by the Victor, and now occupied largely on flying tanker duties, the Valiant still forms a vital part of the British nuclear deterrent. In all, 108 Valiants were built, plus three prototypes, before production ceased in September, 1957, and these included 10 B.(P.R.) Mk. 1s for strategic reconnaissance, plus 13 B.(P.R.)K. Mk. 1s for bombing, recce and tanker/receiver duties, in addition to the original Mk. 1s and some B.(K.) Mk. 1s carrying 10,000 gal. of fuel for tanker duties.

Valiants were used for the initial air launching of Britain's atomic and thermo-nuclear bombs, as well as for test models of the Blue Steel stand-off bomb.

VICKERS VANGUARD. First of the six Vanguard 951s ordered by B.E.A. (which also has 14 953s on order) and 23 952s ordered by Trans-Canada Air Lines began operating in late 1960 and early 1961, respectively, and have justified their manufacturer's claims for extremely low costs per seat-mile. B.E.A.'s remaining 14 Vanguard 953s retain the R.Ty.1 Mk. 506 turboprops of the 951, but have the 37,000 lb. payload and 146,500 lb. gross weight of the later Mk. II. The T.C.A. version, with the Tyne 512s, has a 33,500 lb. payload and a similar gross weight.

VICKERS VC10. Now taking recognizable shape at Weybridge, the clean-wing VC10, with four rear-mounted Rolls-Royce Conway by-pass turbojets was designed initially to B.O.A.C. specifications for medium-range Commonwealth routes. In development, however, the design showed its suitability for the highly competitive North Atlantic routes, combining a design cruising speed of more than 600 m.p.h. with moderate airfield requirements. The original order, in January, 1958, was for 35 for B.O.A.C., with an option on another 20.

This option was taken up for half that number of the Super VC10, which originally had a 28 ft. fuselage extension to increase the passenger capacity from 114/150 to a maximum of 212, although as now planned it will be less "stretched" and carry up to 163 people. The Super VC10 will have up-rated R.Co.42s. The B.O.A.C. order has since been revised, to 15 standard VC10s and 30 of the modified Super VC10.

VICKERS VISCOUNT. About 430 Viscounts of various series have been built since production deliveries began to B.E.A. in 1953, and some activity is still to be seen on the Hurn assembly line. Orders for six more Viscount 810s had been recorded earlier this year and the first of six 828s was delivered to All Nippon Airways on Jne. 12.

The latest production version, with R.Da.10 engines, is the Viscount 840, available new or by conversion. This variant of the well-proven series cruises at 400 m.p.h. and carries up to 73 passengers.

Westland Aircraft, Ltd.

WESTLAND (FAIREY) GANNET. Following the take-over of Fairey Aviation by the Westland company, the Gannet AEW.3 is continuing to be assembled at White Waltham, and has re-equipped the Royal Navy's airborne early-warning squadron—No. 849—from its former Skyraiders. No. 849 Sqn. maintains flights on all operational R.N. carriers, and its aircraft operate on a variety of duties, including submarine detection, radar cover and fighter control and direction.

Crew of the Gannet 3, which is powered by a 3,875 e.h.p. B-S Double Mamba 102 coupled turboprop, comprises pilot and two radar observers. The rear crew members are accommodated in a revised cabin aft of the centre fuselage.

Two new marks of the Gannet, the A.S. 6 and 7, are indicative of its continuing development, although modified from earlier aircraft of the series.

WESTLAND BELVEDERE. Now operational with the R.A.F., the Belvedere H.C. Mk. 1 is powered by two 1,650 s.h.p. Napier Gazelle Series 2 free-turbines, and is serving on troop and freight transport, ambulance and search and rescue duties. The Belvedere is designed for automatic single-engine performance throughout virtually any part of its flight envelope, and 30 are being supplied to the R.A.F. Some remarkably long flights at very high cruising speeds have been completed by Belvederes, including one, with intermediate stops, from Britain to Libya.

WESTLAND ROTODYNE. Since being taken over by the Westland company, as part of the rationalization of the helicopter industry, the Rotodyne has undergone continued development towards its goal of city-centre to city-centre airline travel. Several hundred hours' flight time have now been accumulated, and a great deal of effort has been expended in reducing the noise associated with the rotor-tip pressure jets for the vertical stages of flight.

With its unloaded four-bladed rotor in cruising flight conditions, the Rotodyne is one of the fastest rotorcraft currently flying, and has been paid the honour of having its configuration copied by the Russians. A £4 million development contract was awarded to the Westland company when the Rotodyne project was taken over, and a contribution of £1.5 million was offered by the Government to facilitate its introduction into B.E.A. service.

WESTLAND SCOUT. Derived from the Saro P.531-2 Mk. 1 Wasp, the Scout five- six-seat helicopter is in production for the Army Air Corps, powered by a Blackburn Nimbus free-turbine engine de-rated to 650 s.h.p. It has also completed evaluation trials with the Royal Navy, having provision for the carriage of homing torpedoes as well as four 12.7-mm. machine-guns and six Vickers Vigilant air-to-surface missiles.

WESTLAND WESSEX. Developed from the piston-engined Sikorsky S.58, the Wessex 1 is powered by a single Napier Gazelle shaft turbine developing 1,430 s.h.p. at a one-hour rating at sea level. Produced primarily for anti-submarine duties with the Royal Navy, the Wessex retains all the operational features of the naval S.58, but has a considerably enhanced performance, as well as improved handling. After initial service with No. 700 "H" Flight, for Service trials, the Wessex 1 became operational with No. 815 Sqn., R.N., in July. Development is continuing with the Wessex 2, powered by two D.H. Gnomes and the Wessex 3 with a later Gazelle variant.

WESTLAND WHIRLWIND. With the installation of the 1,024 s.h.p. D.H. Gnome shaft-turbine engine, the long-established Whirlwind, in its Series 3 form, has taken on a new lease of life. Conversion from piston-engined S.55s is simple, although the contract for Whirlwind H.A.R. Mk. 10s also covers the construction of a large number of new rotorcraft of this type. Whirlwind 3s, with the Gnome engine, have also been ordered by the Republic of Ghana.

British Aircraft Industry—Engines

Alvis, Ltd.

LEONIDES. This small radial engine with a long pedigree is still in small-scale production, principally for fixed-wing aircraft although large quantities of helicopter powerplants have also been built. The principal versions are the 550-b.h.p. Series 514 and the 640-b.h.p. Series 531—the latter having a longer stroke of 4.8 in. compared with the 4.41 in. of the earlier version. The Leonides 531 is used in the Scottish Aviation Twin Pioneer 3.

LEONIDES MAJOR. This two-row version of the basic Leonides was produced for the Westland Whirlwind and is in service in large numbers.

Blackburn Engines, Ltd.

(*Hawker Siddeley Group*)

A.129 NIMBUS. A private-venture development, the Nimbus is derived from the Artouste 600, with two axial-flow compressor stages added forward of the centrifugal compressor. It is a turboshaft engine with a free turbine, the shaft drive being taken through a Turmo-type gearbox. Preliminary runs without the shaft drive fitted were made in July, 1958, followed a month later by the first runs as a turboshaft engine. The Nimbus is in production for the Westland Scout helicopter for the Royal Navy and the Army Air Corps, and four of these engines will power the SR-N2 Hovercraft.

PALOUSTE. Made up of components of the Palas and Artouste, the Palouste is an air generator in production for the Royal Air Force and the Royal Navy as a low-pressure starter. The R.A.F. application is in air-starting trolleys; the R.N. uses the Palouste in an air-transportable pod for use aboard aircraft carriers.

TURMO. Based on the Turboméca Palas, the Turmo is a turboshaft engine with a second-stage free turbine which drives an output flange at the rear of the engine. One of these engines has been supplied to Kaman Aircraft for installation in the K-17 helicopter, and others were used in prototypes of the Westland P.531, and an experimental Skeeter.

Bristol Siddeley Engines, Ltd.

BRISTOL SIDDELEY BS100. American sources quote this designation for the lift/thrust engine (see BS53) which is said to be under development for the Republic-Fokker variable-geometry-wing VTOL supersonic fighter to NATO requirements. A thrust of more than 30,000 lb. has been quoted.

BRISTOL SIDDELEY BS81. This designation is believed to apply to the supersonic powerplant under development for the British Aircraft Corporation supersonic transport proposal. No details are available, but it is believed to be a turbojet or turbofan with afterburning for acceleration to a cruising speed of Mach 2.2

BRISTOL SIDDELEY BS75. As a private venture, Bristol Siddeley is developing a turbofan engine tailored to the new generation of small jet transports. Although an entirely new design, the BS75 makes use of Bristol Siddeley experience in so far as many of its components are identical with or closely similar to those already fully developed for existing engines. The two two-stage turbines (L.P. and H.P.), for instance, are almost identical in size with those of the Proteus.

The L.P. turbine drives the front-mounted three-stage fan and the H.P. turbine drives a 10-stage compressor. By-pass ratio is 1.75 : 1 and the initial rating is 7,550 lb. A thrust reverser will be available. The Bristol Siddeley programme calls for the BS75 to make its first run later this year, with flight trials to start next year and fully developed engines available for airline service by 1965. The BS75 has been specified for the BAC-107 and Fokker F-28 short-haul projects.

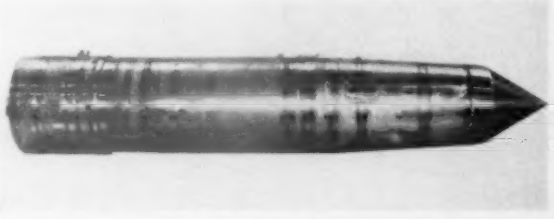
B.E.10 OLYMPUS. Among the most powerful turbojet engines in production anywhere in the World, the Olympus has been under continuous development for more than 10 years, and was the first British "two-spool" turbojet. Advanced versions of the engine have been stated to develop over 33,000 lb.s.t. with reheat, and to be suitable for operation at speeds up to Mach 2.5. These references may be associated with the Olympus variant destined for the B.A.C. TSR.2 supersonic tactical strike and reconnaissance aircraft.

Most important of the present production versions is the BOl.7 Mk. 201, rated at 17,000 lb.s.t. and used in the Avro Vulcan B. Mk. 2. The 20,000-lb. BO1.21 Mk. 301, which has an extra stage in front of the low-pressure compressor, will succeed the Mk. 201 as the Vulcan powerplant in due course. Development engines of the BOl.21 type first flew in a Vulcan test-bed on May 19, 1961.

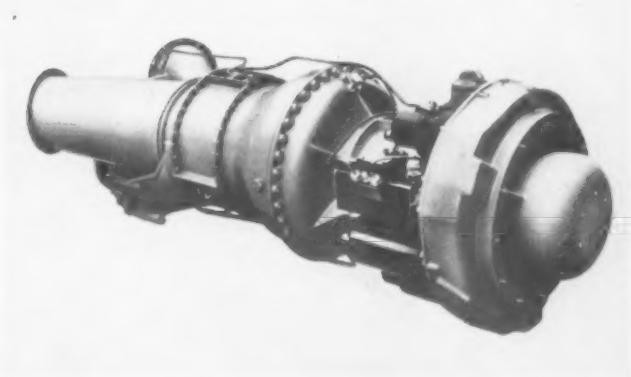
BS53 PEGASUS. Now being developed with support from the Mutual Weapons Development Programme, the Pegasus is the first of a completely new type of engine, able to deliver its thrust through a wide variation of angles for VTOL application. Basically, the engine is a turbofan making use of much of the compressor, combustion system and turbine of the Orpheus, with the addition of a low-pressure turbine and front-fan assembly.

Air from the outer portion of the fan is ducted to two lateral exhaust nozzles, while the exhaust gases from the rear of the engine are similarly discharged through two more lateral nozzles. Each of these nozzles can be rotated so that vertical or horizontal thrust can be obtained; rotation from one to the other in flight permits conversion from hovering to forward flight. The nozzles

(*Continued on page 253*)

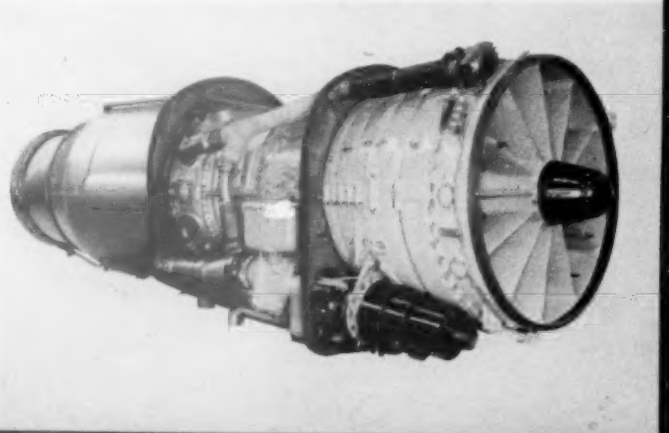


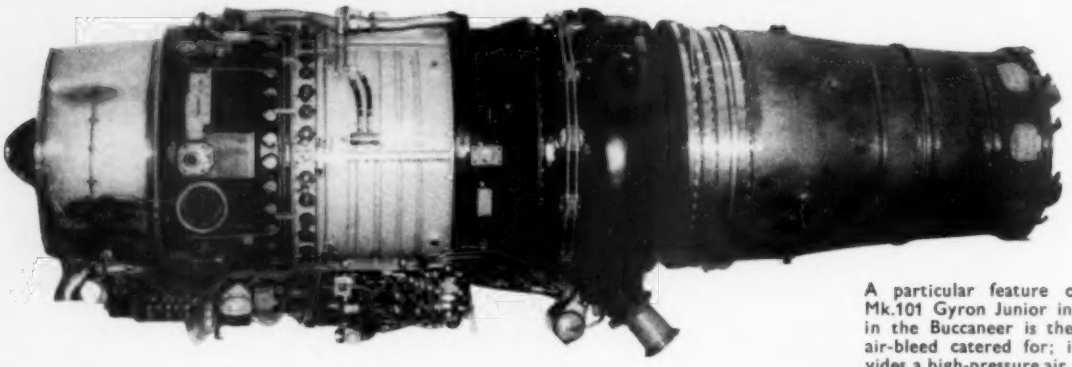
Latest British ram-jet engine revealed is the Bristol Siddeley BSRJ-824.



The Blackburn Nimbus turboshaft engine for helicopters.

With a dry thrust of 20,000 lb., the Olympus 301 (BOl.21) is Britain's most powerful production engine.





A particular feature of the Mk.101 Gyron Junior installed in the Buccaneer is the large air-bleed catered for; it provides a high-pressure air supply for the Buccaneer's comprehensive boundary-layer control system.

Blackburn Buccaneer S.1

Two 7,100-lb.s.t. de Havilland Gyron Junior DGJ.2 turbojets

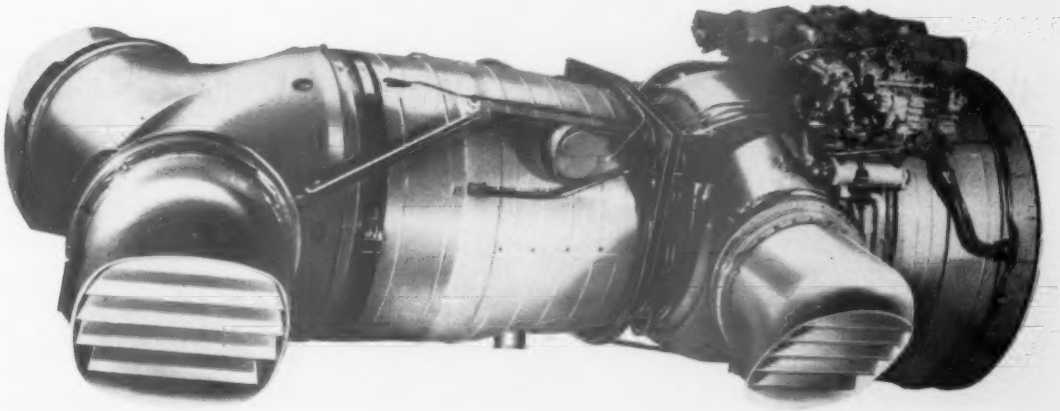
Specially designed as a strike aircraft to operate at transonic speeds at very low heights below radar defence cover, the Buccaneer is a two-seater for shipboard operation. It is in production for the Royal Navy and expected to be in service next year.

Hawker P.1127

Designed from the outset as a VTOL strike aircraft, the Hawker P.1127 is at present undergoing development flight trials. These are aimed at perfecting transition between hovering and level flight, and will provide experience for the development of a Mk.2 variant with supersonic capability to NATO specifications.

One Bristol Siddeley Pegasus BS.53 lift/thrust turbojet

With four eyelid-type deflecting jet nozzles, the Pegasus permits its net thrust to be exerted vertically downwards for VTOL operation, straight back for level flight, or at any intermediate angle for transition.



The Airedale is intended for executive use and is a four seater having a range of 1,000 miles with all four seats occupied. Although based on earlier Auster experience the airframe is to all intents and purposes a new design.

Beagle-Auster Airedale

One 180-b.h.p. Lycoming O-360-A1A flat-four

A great deal of thought has gone into the layout of the Airedale's interior to make it competitive with comparable American types; particularly noteworthy is the arrangement of the controls and the instrument panel.

British Aircraft Industry . . . .

(*Continued from page 249*)

can also be rotated past the vertical to give reverse thrust.

The Pegasus first ran in August, 1959, and an early development model flew for the first time, on Oct. 21, 1960, in the Hawker P.1127. These trials, with the nozzles set for vertical thrust, were followed by the first horizontal flight of the P.1127 on Mar. 13, 1961.

ORPHEUS. Among the most successful British aero-engines, the Orpheus single-spool turbojet was started at the end of 1953 as a private venture to fill a need for a lightweight, medium-thrust unit. The first run was made on Dec. 17, 1954, followed by a 150-hr. type test in the spring of 1955 at a rating of 3,285lb.; the first flight was made on Jly. 18, 1955, in the Folland Gnat.

The BOr.2 Mk. 701 version of the Orpheus rated at 4,700 lb. is in service in the Gnat in India and Finland, and is in production in India. A development of this series, the Mk. 703, powers the new Indian HT24 fighter and is rated at 4,850 lb. A similar rating applies to the BOr.3 Mk. 801 in the Fiat G.91s, but this is now being superseded by the 5,000-lb. Mk. 803. Another BOr.3 variant, the Mk. 805, is de-rated to 4,000 lb.s.t. for the Fuji T1F2 trainer. Engines of this series are being produced in Italy by Fiat and in Germany by Klockner-Humboldt-Dentz for the G.91s.

Another de-rated Orpheus is the BOr.4 Mk. 100, which has lower fuel consumption and longer life than the BO.3 and was developed for the Gnat Trainer. It first flew in a Gnat Mk. 1 test-bed on Aug. 9, 1960, and is rated at 4,230 lb.

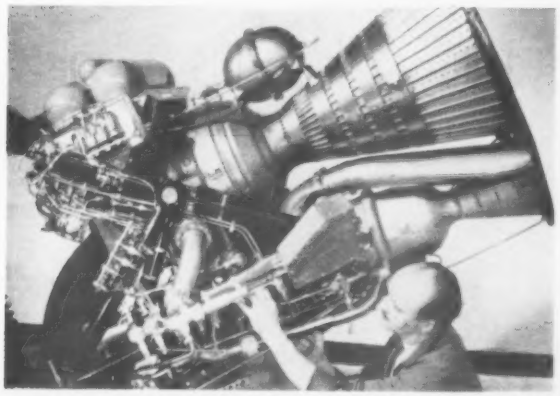
A version of the Orpheus with Bristol simplified re-heat, the BOr.12, was first run in December, 1958, and began its flight test in a Canadair Sabre on Nov. 10, 1959. It has a dry rating of 6,810 lb. and gives 8,170 lb.s.t. with re-heat.

VIPER. Descended from the Armstrong Siddeley side of the family, the Viper is the subject of a development programme aimed, at the present time, at the production of a civil engine. The early Vipers were short-life engines intended for use in target drones such as the Jindivik, and versions of the 100-series and 200-series engines have powered all the Jindivik marks to date.

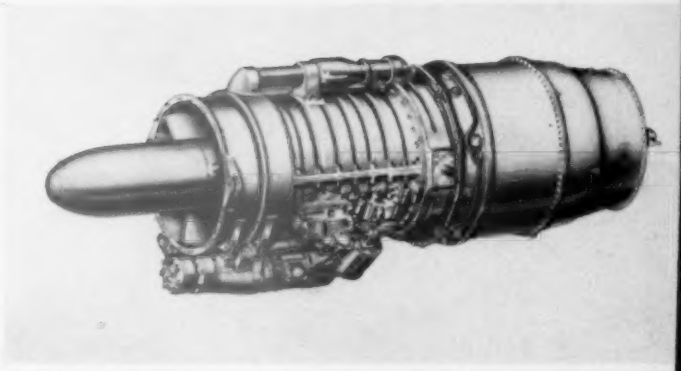
The success of the ASV.3 Mk. 100 in the Jindivik 1 led to production of the ASV.5 Mk. 101, a long-life version of the same engine for use in the Jet Provost. First run in November, 1953, the Mk. 101 also flew in the Folland Midge, and was then developed into the ASV.8 Mk. 102 for the Jet Provost Mks. 2 and 3.

A second series of Vipers was developed to have a greater air mass-flow, primarily for application in later Jet Provosts. The compressor design was changed at the same time, the new engine being identified as the ASV.11, rated at 2,500 lb. As the Mk. 201 it powers the Jet Provost T.Mk. 4, and is produced in Italy by Piaggio for the Macchi MB.326 trainer. A type-test at 2,700 lb. has been completed by the ASV.12 version.

Development began last year of a further improvement of the ASV.11, with the addition of a zero stage at the front of the compressor, giving increased thrust and lower fuel consumption. As the ASV.20 Mk. 502, this engine is rated at 3,000 lb.s.t. for the D.H.125 Jet Dragon. Future versions are projected with powers up to 5,500 lb.s.t.



The Bristol Siddeley Stentor rocket engine is in production for Blue Steel.



The Bristol Siddeley Viper 20 is being developed for civil applications, including the de Havilland Jet Dragon.

GAMMA. The four-chamber Gamma Mk. 201, powerplant for the Saro Black Knight re-entry research vehicle, was developed originally by Armstrong Siddeley from work on a single chamber Gamma at the Rocket Propulsion Establishment. Like the Stentor, the Gamma operates on hydrogen peroxide and kerosene; the H.T.P. is decomposed into superheated steam and oxygen by passage through a catalyst pack, and spontaneous ignition occurs upon contact with the kerosene.

STENTOR. Powerplant for production models of the Avro Blue Steel stand-off bomb, the Stentor BSSt.1-1 is a dual-chamber liquid rocket engine, revealed a year ago. The two chambers are of different sizes and appear to have thrusts in the ratio of about 4:1, with a total combined output of some 20,000 lb. It is presumed that the smaller unit is of variable thrust. The propellents are H.T.P. and kerosene.

THOR AND BSRJ-824. Europe's first production ram-jet, the Thor was designed for missile applications and is the powerplant of the Bloodhound surface-to-air missile, in service with the R.A.F. and ordered by Australia, Sweden and Switzerland. Details of the BT-2 production version are restricted, but the earlier and shorter BT-1 was rated at 5,275 lb. static net internal gauge thrust at Mach 2 at sea level.

A newer ram-jet generally similar to the Thor, designated the BSRJ-824, was exhibited in the S.B.A.C. display in 1960 and is probably intended for later Bloodhound variants.

de Havilland Engine Co., Ltd.

(*Hawker Siddeley Group*)

GYRON JUNIOR. Most important of the de Havilland engines, the Gyron Junior has been under development since September, 1954, with full backing of the Ministry of Aviation (originally M.o.S). The initial version, the DGJ.1, which was rated at 7,000-lb.s.t. at sea level, completed its first 150-hour test run in September, 1956, and was first flown in the port nacelle of a Canberra test-bed in May, 1957. In its production form, as the 7,100-lb.s.t. DGJ.2 (Mk. 101), the Gyron Junior powers the pre-production models of the Blackburn Buccaneer and the first production batch of Buccaneer S.Mk.1s. For this application, an air-bleed manifold around the compressor makes it possible to utilize a large proportion of the compressor airflow for boundary-layer control.

A supersonic version of the Gyron Junior identified as the DGJ.10 was first run on Oct. 7, 1957, and is the powerplant for the Bristol 188 all-steel supersonic research aircraft. An afterburner operating at 2,000° K. combustion temperature has been designed for the DGJ.10, giving a 40% increase on the static thrust of 10,000 lb. This version of the engine first flew in a Gloster Javelin test-bed on Jan. 31, 1961. Mention has been made of a later supersonic version, the DGJ.20.

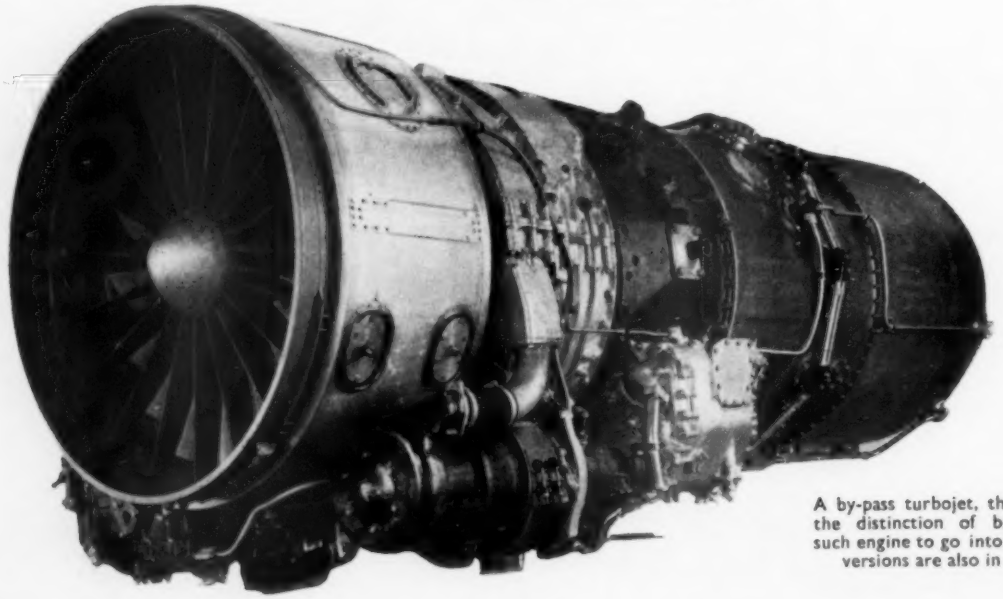
GNOME. During 1958, the de Havilland company concluded an agreement with General Electric for the manufacture in England of the T58 turboshaft engine. The design was re-engineered for British production with a Lucas fuel system and other changes. On Jne. 5, 1959, the first British-

(*Continued on page 256*)

Handley Page Victor B.2

Four 17,250-lb.s.t. Rolls-Royce Conway RCo.11 turbojets

Latest of the V-bombers to go into R.A.F. service as part of the deterrent force, the Victor 2 is intended to carry the Avro Blue Steel stand-off bomb. This version is said to be capable of carrying the Skybolt ALBM but at present there are no plans for this.



A by-pass turbojet, the Conway has the distinction of being the first such engine to go into service. Civil versions are also in production.

Handley Page Herald

Two 2,105-e.h.p. Rolls-Royce Dart RDa.7/2 turboprops

Now in service with Jersey Airlines, the Herald has been developed specifically for feeder-line operation with a capability of operating from the smaller airfields. B.E.A. are to have three of these aircraft for operation on their Scottish routes.

Undercarriage stowage—always a problem with high-wing monoplanes—has been neatly solved in the Herald, in which the Darts are housed in very clean nacelles.

British Aircraft Industry . . . .

(*Continued from page 253*)

built T58, named the Gnome, made its first run, and flights in a modified Whirlwind helicopter followed later in the same year.

Several versions of the turboshaft Gnome have been announced. The initial version is the 1,050-s.h.p. H.1000, for use in the Whirlwind Series 3 and H.A.R.10 civil and military helicopters. The 1,250-s.h.p. H.1200, to run this year, will be used in the Westland Wessex 2 in coupled form, driving a single shaft through a common gearbox. A further development, the H.1400, will be rated at 1,400 s.h.p. Gnomes have been ordered for the Agusta-Bell 204Bs purchased by the Italian Air Force and Sweden, and for the prototype three-engined Agusta 101G. One has powered an experimental Westland Scout.

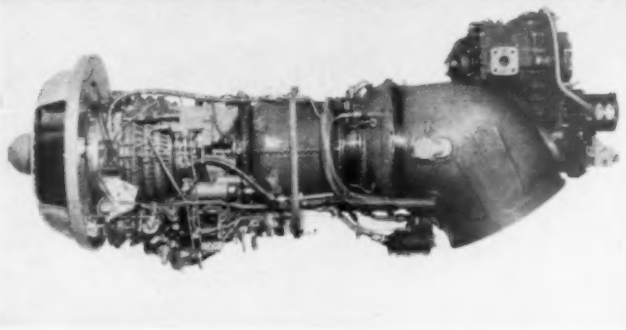
A de Havilland development of the Gnome is the P.1000 turboprop version, in which a drive is taken from the high-speed gearbox, forward over the top of the engine to an epicyclic gearbox over the intake. The P.1000 ran on Sept. 5, 1960, and is rated at 1,000 s.h.p. plus 144 lb. residual thrust. A P.1200 version rated at 1,150 s.h.p. is being developed.

SPECTRE and DOUBLE SPECTRE. Development of this liquid-propellent rocket engine was started by de Havilland for use in mixed-powerplant fighters. Both fixed-thrust and variable-thrust versions were developed, the current version being the DSpe.4 with a constant thrust of 8,000 lb. for a weight of 393 lb. This is used in recoverable packs as an assisted take-off unit for the Handley Page Victor. The Double Spectre was developed to power the test batch of Avro Blue Steel stand-off bombs, and comprises a Spectre DSpe.4 mounted above a DSpe.5, the latter having variable thrust.

Both engines are rated at 8,000 lb. thrust, so the thrust applied to the Blue Steel when it is launched can be varied between 8,000 lb. and 16,000 lb. The first flight trial of the Double Spectre, which operates on high test peroxide and aviation kerosene, was made on Oct. 6, 1959.

Left, one of the range of Rolls-Royce lightweight lift or thrust engines, the RB.145.

Below, the Rolls-Royce Spey, in production for the Trident and BAC-111.



The de Havilland Gnome in its turboshaft H.1000 form for helicopters.

GIPSY QUEEN. This venerable six-cylinder in-line piston engine remains in production for the Dove, Heron and other aircraft. The most recent development is the Gipsy Queen 70 Mk. 3, rated at 384-400 b.h.p. at sea level and used in the Dove 8. The 240-250 b.h.p. Queen 30 Mk. 2 powers the Heron.

GIPSY MAJOR. The four-cylinder version of the Gipsy is currently available as the Series 200 (192-200 b.h.p. at sea level) or the Series 215 with a turbo-supercharger, rated at 215 b.h.p. at sea level.

Napier Aero Engines, Ltd.

ELAND. Development of this medium power turboprop is continuing with a view to obtaining higher powers. The latest announced variant is the Eland E.248 which will have a take-off rating of 3,750 e.h.p. and continuous rating of 3,420 e.h.p. The production Eland 504A in Canadair 540 transports is rated at 3,500 e.h.p. Other Eland variants have been the E.211 and E.229 for helicopters with mechanically driven rotors (e.g. the Westland Westminster) and the E.151 in the Westland Rotodyne.

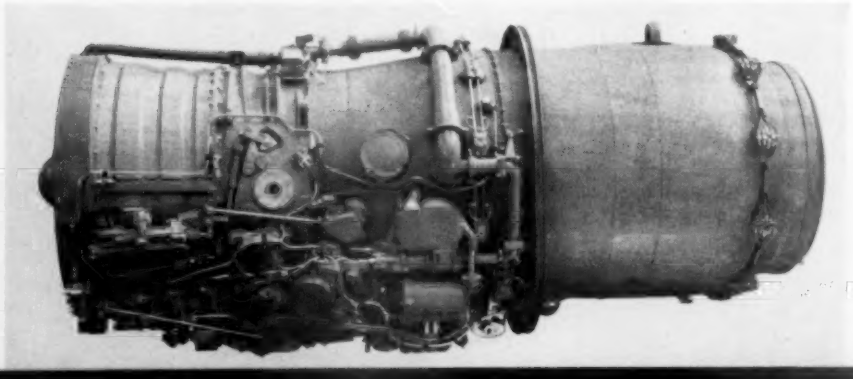
GAZELLE. The principal Napier aero-engine at the present time, this is a turboshaft unit for helicopters; it has a free turbine and is suitable for installation in any attitude. Work on the project began in June, 1954, and the engine first ran on Dec. 3, 1955, developing its full rated power of 1,260 s.h.p. on Dec. 14. The first Gazelle installation was in a Wessex 1, flown in May, 1957; production models of the Wessex are now powered by the 1,450-s.h.p. Gazelle NGa.13 Mk. 161. The two engines in the Westland Belvedere are NGa.2 Mk. 101s, rated at 1,465 s.h.p. but able to give 1,650 s.h.p. in the case of failure of one engine. Future variants of the Wessex and Belvedere engines will be operated to 1,540 s.h.p. with a contingency rating of 1,750 s.h.p. in the Belvedere.

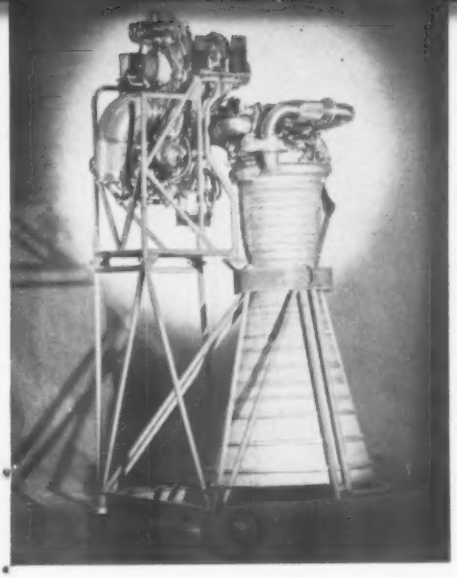
Under development for the Wessex 3 is the Gazelle NGa.9, in which new material is used for the turbine blades and the air mass flow increased by 10%. Normal and contingency ratings will be 1,750 s.h.p. and 2,000 s.h.p. respectively. Still greater powers are projected for the NGa.20, with a contingency rating of 2,970 s.h.p. For civil applications such as the Westland 192C, the Gazelle 512 has an annular air intake rather than the radial type.

Rolls-Royce, Ltd.

AVON. This engine, development of which began in 1947, as the AJ.65, can be considered in two separate families, for military and commercial applications. The latest of the commercial engines is the Avon 533R which recently entered service in United Air Lines' Caravelle VIs on U.S. domestic operations. The 533R is Stage VI of the Avon RA.29, the latter being the first airline Avon, for use in the Comet 4 and Caravelle I at a rating of 10,500 lb.s.t.

A change of turbine blade material and a two-position nozzle were features of the 11,400 lb.s.t. Stage III engine





Power for the Blue Streak space vehicle will be provided by two of these Rolls-Royce RZ.2 rocket engines.

used in the Caravelle III, and the Stage VI has the addition of a "zero-zero" stage at the front of the compressor (the zero stage had been added when the RA.29 was first developed). At 12,200 lb.s.t., the Avon 531 is used in the Caravelle VI, while the 533R for the Caravelle VIR, in addition to having a thrust reverser, operates at higher turbine temperatures and gives 12,600 lb.s.t.

Of the military engines, the RA.34 or RB.146 is now reaching the production stage for later marks of the English Electric Lightning, as the 300-Series. Developed from the existing R.24 200-Series engines, they incorporate features of the RA.29, including the zero compressor-stage, but still have the original two-stage turbine whereas the civil engines have three stages. Steel or titanium is used for 11 of the 16 compressor stages. The RB.146 has a convergent-divergent variable-reheat nozzle in its Mk. 67 version for the Mirage IIIO application (first flown on Feb. 13, 1961), while the Mk. 60, in production in Sweden by Svenska Flygmotor as the RM-6C for the Saab Draken, has an SFA afterburner.

CONWAY. Like the Avon, the Conway has both military and civil applications. From earlier versions of the Conway, Rolls-Royce began development of the present series in 1956, for the Victor B. Mk. 2 and for the T.C.A. DC-8s. Deliveries began in 1959, and the commercial Conway at its 17,500-lb. s.t. RCo.12 rating entered service in the DC-8 (as Mk. 509) and Boeing 707 (as Mk. 508) in April, 1960. Later this year, the RCo.15B will go into service in the C.P.A. DC-8s. This is rated at 18,500 lb.

For the VC10 and later DC-8 and Boeing 707 variants, the RCo.42 family is under development, with a completely new low-pressure compressor and turbine system and a by-pass ratio of 0.6. The RCo.42/1 will be rated at 20,250 lb. and the RCo.42/3, with higher r.p.m., at 21,800 lb. s.t.

DART. Development of the Dart, most successful of all the Rolls-Royce turbine engines, began 15 years ago and continues to-day. Work is concentrated on the RDa.7, the first to have a three-stage turbine and used in the Herald, Argosy and versions of the Viscount, F-27 and Avro 748; the RDa.8, a military version with higher operating temperatures and water/methanol boost to 2,680 e.h.p., used in the military Argosy; and the RDa.10, similar to the RDa.8 but with 15% greater mass flow and reversing propeller, for the Namco YS-11.

SPEY. The newest Rolls-Royce by-pass turbojet for commercial applications, the Spey is the powerplant for the de Havilland Trident, B.A.C. One-Eleven, and a number of projected transports. Its development began in mid-1959, as the RB.163, when an earlier project, the RB.141, was found to be rather too large for the Trident. A number of RB.141s have been built and tested, and the results of these trials have been incorporated in the RB.163.

The Spey first ran in December, 1960, and is now the subject of intensive development. Flight trials will begin in a Vulcan in September, and the engine should be flying in the first Trident before the end of this year. The guaranteed minimum thrust initially will be 9,850 lb. s.t., but much higher powers will certainly be achieved, not least in the RB.168 military version, with or without afterburner. The first military application will be in the Buccaneer 2.

TYNE. With a difficult metallurgical problem overcome in the past 12 months, the Tyne has been in airline service since the beginning of the year in its RTy.1 (5,325 e.h.p.) RTy.11 (5,500 e.h.p.) and RTy.12 (5,855 e.h.p.) versions, and will power the Belfast in due course. For the Breguet Atlantic, the RTy.21 will be rated at 6,180 e.h.p. and with water/methanol boost in the Transall C.160, the similar RTy.22 will achieve 7,075 e.h.p.

The Tyne has also been chosen to power the production versions of the Westland Rotodyne. This engine is expected to be a derivative of the RTy.12, and will have a maximum contingency rating of more than 7,000 e.h.p.

ROLLS-ROYCE RB.145. Developed from the RB.108 (the engines used for direct lift and propulsion in the Short SC.1) the RB.145 similarly is suitable for both lift and propulsion. Compared with the RB.108, it has a zero-stage on the compressor and other major changes. It is rated at 2,750 lb., and is in process of being further developed. Later Rolls-Royce engines for VTOL applications are reported to include the 3,970-lb. s.t. RB.153 (available in a pod installation to give the Traissall C.160 STOL capability) and the RB.162, which was officially referred to last May as the subject of joint development in Britain, Germany and France. Rolls-Royce claim to have achieved a thrust-to-weight of 16:1 with their latest jet lift engines.

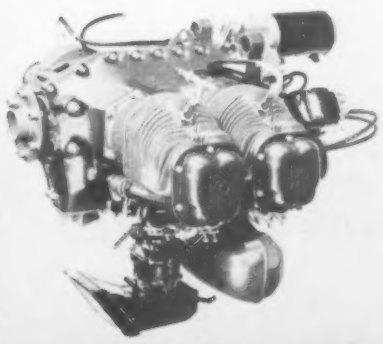
ROLLS-ROYCE RB.167. No details are available of this Rolls-Royce project for supersonic transport applications.

ROLLS-ROYCE RB.179. Mention of this engine was made recently in connection with the de Havilland DH.126 project. It is presumed to be in a similar power bracket to the 7,550-lb. s.t. Bristol Siddeley BS.75.

CONTINENTAL. Rolls-Royce has acquired a licence to manufacture the range of Continental piston engines, and has established a Light Aircraft Engine Department in the Motor Car Division at Crewe. British-built engines will have no modifications from their U.S. counterparts, with which they will be fully interchangeable. In the first instance, Rolls-Royce is producing the 100-b.h.p. O-200A series of flat-fours, for delivery in mid-1962, to be followed by engines in the 150-b.h.p. O-300 series and the 300-b.h.p. IO-470D engine with direct injection.

ROLLS-ROYCE RZ.12. This is the powerplant for Blue Streak, comprising two RZ.2 rocket units with entirely independent propellent feed, combustion and control. Developed and adapted from the Rocketdyne S.3 engines in the Thor and Jupiter, the RZ.12 will feature in any satellite launching applications of Blue Streak. The engine operates on liquid oxygen and kerosene, and produces a thrust of 137,000 lb. at sea level increasing to 168,000 lb. at cut-off after some 120 seconds, at about 250,000 ft.

The first RZ.2 was fired at Westcott in March, 1959, following tests with six RZ.1s which were virtually copies of the S.3. The first RZ.12 was fired at Spadeadam in March, 1960; and up to May, 1961, the RZ.2 had completed 317 tests of scheduled duration, and the RZ.12, 48.



A Continental O-200 as made by Rolls-Royce.

Rollason Aircraft & Engines, Ltd.

ARDEM. For use in the Turbulent and other lightplanes, the Ardem 4CO2 flat-four engine is produced by Rollason, which has delivered some two dozen to date. Several modifications have been made to the original French design, including the provision of Lucas magnetos and an impulse starter, large-bore aluminium cylinders, a Solex side-entry carburetter and a hand-starter in the cockpit.

Rover Gas Turbines, Ltd.

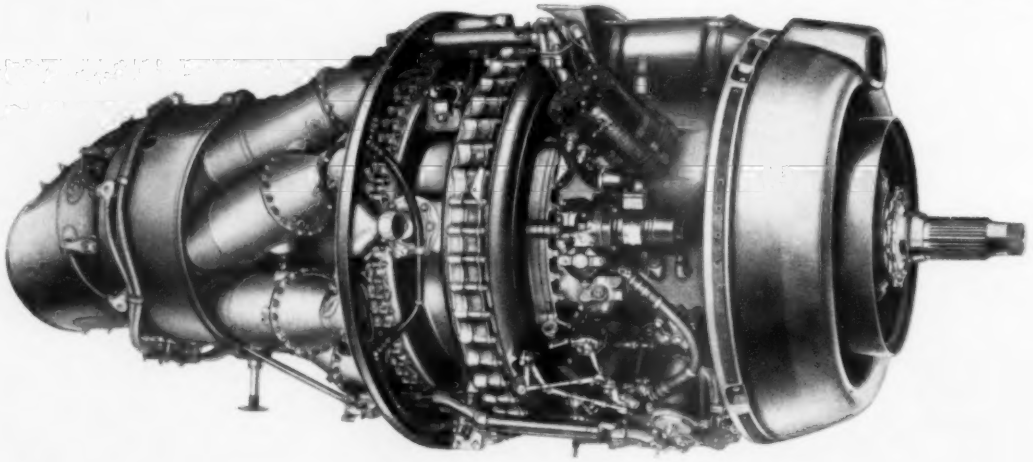
TP.60/TP.90. These designations refer to variants of a small turboprop developed by Rover as a powerplant for light aircraft. They are derived from the company's experience with airborne auxiliary powerplants and industrial gas turbines, and are among the smallest turboprops ever developed for aircraft application. The TP.60 has flown successfully in the Currie Wot, with automatic propeller pitch. The TP.90 has a hydraulically controlled propeller.

Avro 748

Two 1,740-e.h.p. Rolls-Royce Dart RDa.6 turboprops

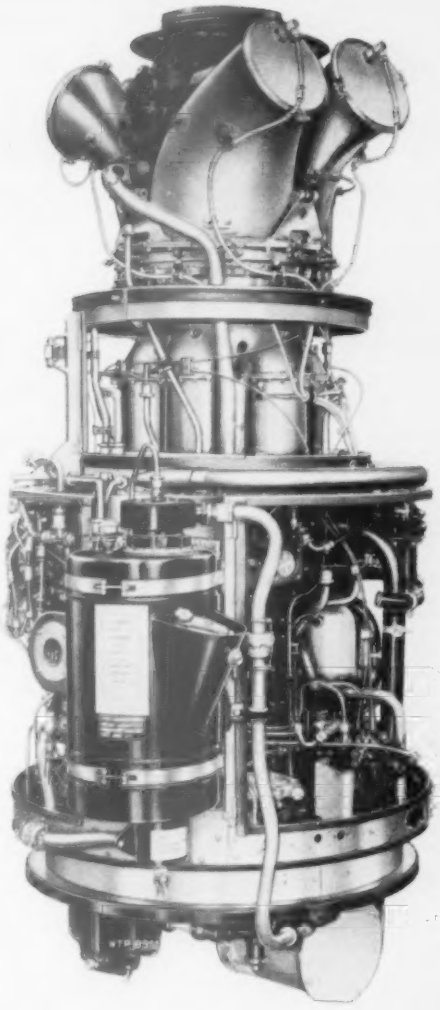
Designed as a short/medium-range feeder-line transport, the Avro 748 is on order for a number of operators. Several versions are available; the Series 2 aircraft, for example, has the more powerful RDa.7 Darts. The Avro 748 is also to be produced in military form and is being built in India for the Indian Air Force.

The Dart RDa.6 is one of a number of versions and developments of an engine which was outstanding in being the first turboprop powerplant to go into airline service. The latest version delivers 3,030 e.h.p. for take-off.



Westland Belvedere HC.1

Two 1,650-s.h.p. Napier Gazelle NGa.2 gas turbines



The Gazelles in the Belvedere are mounted in a near-vertical position. The powerplant shown here is a completely self-contained "change unit" with an integral oil system.

In production for the Royal Air Force, the Belvedere is scheduled to reach squadron service before the end of the year. It is intended for general purpose duties as a troop transport, paratrooper, ambulance or pure cargo carrier.

British Aircraft Industry—Missiles

AVRO BLUE STEEL MK. 1.—In production for R.A.F. Bomber Command, this "stand-off bomb" is being fitted to the Vulcan B.2 and Victor B.2, each with one missile beneath the fuselage. The missile, which has a canard configuration, with steerable foreplanes, ailerons and rudder, is approximately 35 ft. long and 13 ft. in span. Propulsion is by the twin-chamber Bristol Siddeley Stentor employing HTP and kerosene with probable thrusts in the ratio of 16,000 lb. and 4,000 lb.

The inertial guidance system is by Elliott Brothers (London), Ltd. Operation depends on synchronous matching of navigational information between bomber and missile maintained until release, giving position, velocity vector, acceleration, altitude and target data. A reported Blue Steel Mk. 1* is said to have greater range.

A.W.A. SEASLUG Mk. 1.—This highly developed shipboard surface-to-air missile system has below-deck storage and hydraulic remote-handling equipment serving single, twin or triple lattice launchers. The missile itself has cruciform wings and steerable tail blades, and an integral I.C.I. solid-propellent rocket motor with four jettisonable wrap-around boosts on the forebody. The beam-rider guidance receiver is by G.E.C., with Sperry controls.

Seaslug has been adopted by the Royal Navy and will equip its "Hampshire"-class guided-missile destroyers. In April the Royal Navy's trials ship, H.M.S. "Girdle Ness," returned to Devonport after nearly two years in the Mediterranean where the missiles were launched with outstanding accuracy and reliability. A.W.A., Sperry and G.E.C. have been chosen as main contractors for Seaslug Mk. 2.

BRISTOL/FERRANTI BLOODHOUND MK. 1.—This surface-to-air missile is the subject of the largest missile production programme outside the United States and the U.S.S.R. In addition to being in service with the R.A.F. for more than two years, Bloodhound was purchased for evaluation in 1958 by the Royal Swedish Air Board and in 1959 was ordered for the Royal Australian Air Force.

With twin 16-in. Bristol/Siddeley Thor ramjets above and below the body, the missile "twists and steers" to the target using a semi-active radar homing system acting on moving wings. Operation is in conjunction with B.T.H. Sting-Ray target tracking and illuminating radar.

BRISTOL/FERRANTI BLOODHOUND MK. 2.—Similar in outward appearance to Bloodhound Mk. 1, this improved version employs constant-wave radar for better target discrimination at low angles of elevation, and greater security from counter-measures. This system has been developed in conjunction with the M.o.A. by Associated Electrical Industries and Ferranti. The guidance electronics are fully transistorized and there are other changes affecting performance, operational flexibility, and lethality.

In July, this advanced weapon system was the subject of a substantial order from the Royal Swedish Air Force Board. It has also been chosen by Switzerland. In each case, the choice was made on purely technical grounds after long evaluation and in face of very strong competition. Although no money value has been officially placed on these orders, the sum is believed to be near £35 million, a considerable contribution to U.K. exports.

BRISTOL AEROJET METEOROLOGICAL ROCKET.—This 7 ft. 6 in. solid-propellent rocket is intended for launching from land sites and ships. Designed to a Meteorological Office specification, it will be capable of carrying 10 lb. of air-temperature and pressure-measuring instruments to a height of about 40 miles. Test firings are scheduled for next year, either at South Uist in the Hebrides or Aberporth, South Wales.

DE HAVILLAND FIRESTREAK.—Now well-established with the R.A.F. and the Royal Navy, the IR-homing Firestreak forms the basic armament of the Gloster Javelin, the English Electric Lightning, and the de Havilland Sea Vixen. The warhead is detonated by a proximity-fuse arrangement which includes front and rear windows and an electronics pack contained in a tapering nose section. Cruciform fixed wings and cruciform steerable tail blades are fitted. The motor employs solid-propellent.

DE HAVILLAND RED TOP.—Similar to Firestreak but described as having "greatly enhanced capabilities," the most obvious external differences with Red Top are wings and control blades of increased span (both cutaway at the trailing-edges) for improved performance at extreme altitude. The body, which is 8.75 in. in diameter, remains constant to the nose, terminating at eight optically flat glass panels shrouding an IR heat-seeker of improved type. Internal components have been considerably rearranged and there is probably a larger solid-propellent motor or one of improved specific impulse. Wing span is approximately 36 in. as compared with 29.4 in. for Firestreak.

Operationally, Red Top is said to improve markedly on the lead-pursuit-course capability of its predecessor.

ENGLISH ELECTRIC BLUE WATER.—This highly optimized tactical missile is being developed for the British Army. It has full cross-country mobility and, with its two-stage solid-propellent motor, can be kept for long periods at instant readiness under cover.

The extreme simplicity of the launching and operational arrangements has won high praise for the system, which consists of a computer transported in a Land-Rover and a missile carried on a launcher/transporter mounted on a standard three-ton lorry. The missile is 25 ft. long, has a body diameter of 24 in., and a wing-span of 81 in. It can be readily accommodated in the new A.W.A. Argosy transport aircraft.

ENGLISH ELECTRIC THUNDERBIRD MK. 1.—One of the most thoroughly developed weapon systems in the Western World, the Thunderbird Mk. 1 surface-to-air missile has been in production for the British Army for more than two years. It is highly mobile for field deployment, all portions of the system being mounted on standard Army vehicles, including power generator, control and test equipment, tactical radar, and tracking and illuminating radar. The missile has fixed cruciform wings and steerable cruciform tail blades; it employs an integral solid propellent rocket motor with four wrap-around jettisonable boosters. The semi-active radar guidance receiver is by Marconi.

ENGLISH ELECTRIC THUNDERBIRD MK. 2.—Externally similar to the Mk. 1, Thunderbird Mk. 2 has constant-wave radar and improved performance. No details are available.

PYE PYTHON.—A private venture, Python is a wire-guided anti-tank missile showing considerable ingenuity in design and operational dexterity. Propelled by a Bristol Aerojet solid-propellent boost/sustainer motor (originally developed by I.C.I.), the missile has a launching weight of 80 lb., including a 30 lb. warhead. The four cruciform wings span 24 in.

SHORT SEACAT MK. 1.—This small, economically produced, subsonic, command-guided, short-range, shipboard missile embodies steerable cruciform wings with fixed fins indexed at 45°. The weapon system includes a launcher, four missiles and a director turret. Exceptional manœuvrability and accuracy are claimed.

The weapon system is being developed for the Royal Navy, the Royal Australian Navy, and the Royal New Zealand Navy. It has also been ordered by Sweden and Germany for evaluation.

SHORT SEACAT MK. 2.—A development of Seacat Mk 1 with supersonic performance and greater range, this missile has a cylindrical body with a long tapering nose. There are four fixed, highly swept, triangular wings of 20-in. span and four steerable tail blades. Despite the radically changed appearance necessitated by supersonic requirements, much of the internal equipment is common to the original Seacat. There is a solid-propellent, integral motor, probably two-staged.

SHORT TIGERCAT.—Private venture, land-based derivative of Seacat Mk 1 with Elliott Brothers (London), Ltd., guidance equipment.

VICKERS VIGILANT V.897.—Outstandingly effective wire-guided anti-tank missile which has been the subject of a substantial order by the British Army for assessment trials. The 31-lb. missile embodies fixed cruciform wings of 11-in. span having hinged trailing-edge controls. The integral boost/sustainer motor is by I.C.I.

British Aircraft Industry Data Sheets

Commercial Transport Aircraft

AIRCRAFT	POWER PLANT				ACCOMMODATION									DIMENSIONS				LOADINGS			
	No.	Type	T.-o. power (each)		Normal first class	Typ. mixed class	Max. coach	Internal cabin*					Total freight hold volume†	Span	Length o.a.	Height o.a.	Gross wing area	Wing loading (t.-o. wt.)	Wing loading (land. wt.)	Power loading	
								Length	Max. height	Max. width	Floor area	Usable volume									
			lb.s.t. e.h.p. or b.h.p.	r.p.m.				ft. in.	in.	in.	sq. ft.	cu. ft.	cu. ft.	ft. in.	ft. in.	ft. in.	sq. ft.	lb./sq. ft.	lb./sq. ft.	lb./lb.s.t. lb./e.h.p. or lb./b.h.p.	
Argosy Srs. 200	4	Dart 526 (RDa.7)	2,100	15,000	—	—	89	46 8	80	120	426	3,680	—	115 0	86 9	27 0	1,458	60.0	55.5	10.5	
Avro 748 Series 1	2	Dart 514 (RDa.6)	1,760	14,500	40	—	44	46 6	76	96.5	296	1,990	Nil	95 0	67 0	24 10	795	41.5	41.5	9.48	
Avro 748 Series 2	2	Dart 531 (RDa.7)	2,105	15,000	40	—	44	46 6	76	96.5	296	1,990	Nil	95 0	67 0	24 10	795	45.25	44.65	8.55	
Avro 748E	2	Dart 531 (RDa.7)	2,105	15,000	48	—	60	52 6	76	96.5	—	—	Nil	95 0	73 0	24 10	795	50.4	48.4	9.5	
Avro 748 Super E	2	Dart (RDa.10)	2,400	15,000	48	—	60	52 6	76	96.5	—	—	Nil	95 0	73 0	24 10	795	54.1	52.8	8.9	
BAC One-Eleven	2	Spey 505-14 (RB.163-1)	10,400	12,490	—	57	74	58 9	78	124	539	3,150	500	88 6	93 8	23 9	980	69.6	66.4	3.28	
Belfast	4	Tyne RTy.12	5,730	15,250	—	242	—	84 6	160	192	1,012	10,000	—	158 9½	136 5	47 0	2,466	88.5	83.0	9.5	
Caribou	2	P. & W. R-2000-7M2	1,450	2,700	—	—	32	28 9	75	87	175	1,150	Nil	96 0	72 7	31 9	912	28.5	28.5	8.97	
Carvair (ATL 98)	4	P. & W. R-2000-7M2	1,450	2,700	—	—	85	80 2	81	118.5	665	4,350	151	117 6	102 7	30 0	1,462	50.5	43.9	12.7	
Comet 4	4	Avon 525B	10,500	8,050	60	67	81	71 9	79	116	439	2,815	570	114 10	111 6	29 6	2,121	76.4	56.6	3.86	
Comet 4B	4	Avon 525B	10,500	8,050	72	88	101	78 3	79	116	529	3,160	640	107 10	118 0	29 6	2,059	76.7	58.2	3.76	
Comet 4C	4	Avon 525B	10,500	8,050	72	88	101	78 3	79	116	529	3,160	640	114 10	118 0	29 6	2,121	76.4	56.6	3.86	
Herald 100	2	Dart 527 (RDa.7/2)	1,910	15,000	38	42	48	48 9	76	104	260	2,193	Nil	94 4½	71 11	24 0	886	45.1	44.6	9.5	
Herald 200	2	Dart 527 (RDa.7)	2,105	15,000	—	50	56	41 9	76	104	—	1,802	Nil	94 4½	75 5	24 0	886	45.1	44.6	9.5	
Heron 2	4	Gipsy Queen 30 Mk. 2	250	2,500	14	—	17	23 0	69	54	89	515	127	71 6	48 6	15 7	499	27.1	26.4	13.5	
Jet Dragon (DH 125)	2	Viper 502 (ASV.20)	3,000	13,800	6	—	—	18 6	69	70	—	—	—	44 0	43 6	14 0	342	52.6	—	3.0	
Rotodyne	2	Tyne	—	—	—	65	—	52 9	84	116.5	480	3,360	Nil	75 0	69 5	27 3	—	—‡	—‡	—	
Trident	3	Spey (RB.163/1)	10,400	12,490	—	83	100	66 6	80	135.5	708	4,440	620	89 10	114 9	27 0	1,358	77.4	73.6	3.36	
Twin Pioneer 3	2	Leonides 531/8B	625	3,200	—	16	19	22 8	69	72	129	730	96	76 6	45 3	18 0	670	21.8	21.8	11.4	
Vanguard II	4	Tyne 512 (RTy.11)	5,545	15,200	76	97	139	90 0	82.5	128.8	893	5,690	1,360	118 0	122 10½	34 11	1,529	96.0	88.3	6.6	
VC10	4	Conway 540	20,250	9,955	88	114	150	91 4	90	138	—	6,700	1,350	140 0	158 10	39 1½	2,800	106.9	70.5	3.7	
Super VC10	4	Conway 550 (RCo.42/3)	22,500	10,172	—	138	163	103 0	90	138	1,130	7,600	1,950	140 0	171 8	39 6	2,800	115.0	80.4	3.58	
Viscount 810	4	Dart 525 (RDa.7)	1,990	15,000	52	53	73	54 0	78	120	520	2,680	370	93 8½	85 8	26 9	963	75.4	66.4	9.11	

* Internal cabin dimensions exclude the flight deck. † Freight volumes exclude capacity within the main cabin. ‡ Rotor diameter is 109 ft., area 9,320 sq. ft., disc loading 6.3 lb./sq. ft.

AIRCRAFT	WEIGHTS						PERFORMANCE										
	Basic Op.	Total fuel	Mfrs. max. payload	Max. take-off	Max. landing	Max. zero fuel	Typical Cruise			App-roach speed	Take-off Field length required			Landing distance from 50 ft.	Range (take-off to landing) no reserves				
							Speed	Alt.	Wt.		I.S.A. s.l.	I.S.A. + 15°C. s.l.	I.S.A. 5,000 ft.		With max. fuel				With max. payload
															Range	Payload	Speed	Alt.	
	lb.	lb.	lb.	lb.	lb.	lb.	knots	ft.	lb.	knots	ft.	ft.	ft.	ft.	n. mi.	lb.	knots	ft.	n. mi.
Argosy Srs. 200	49,000	28,500	31,000	88,000	84,000	80,000	240	18,000	75,000	118	4,900	5,200	6,350	3,350	2,140	10,200	240	18,000	500
Avro 748 Series 1	22,614	3,600	10,586	36,800	36,300	33,200	223	15,000	34,000	92	3,860	—	—	2,170	1,520	—	—	—	550
Avro 748 Series 2	23,044	4,670	10,986	38,800	38,000	34,030	248	20,000	36,000	94	3,640	—	—	2,270	1,660	—	—	—	810
Avro 748E	24,000	4,100	13,000	40,100	38,500	37,000	245	20,000	38,000	—	3,900	—	—	2,280	1,640	7,700	—	—	680
Avro 748 Super E	24,800	4,200	14,000	43,000	42,000	38,800	270	20,000	40,000	—	3,800	—	—	2,430	1,570	—	—	—	650
BAC One-Eleven	42,800	18,000	14,000	68,250	65,000	58,000	469	25,000	66,000	120	5,200	6,358	7,600	5,810*	1,835	7,300	435	30,000	1,070
Belfast	111,000	80,720	85,000	218,000	205,000	196,000	300	28,000	170,000	127	6,900	7,500	9,500	5,000*	5,550	26,280	304	28,000	1,150
Caribou	17,350	4,860	7,550	26,000	26,000	26,000	158	7,500	26,000	72	1,645	—	—	1,020	1,100	3,000	158	7,500	—
Carvair (ATL98)	41,365	14,800	17,635	73,000	64,170	59,000	180	10,000	65,000	93	5,300	5,958	7,050	2,800	3,000	10,000	177	10,000	2,000
Comet 4	75,150	71,260	20,300	162,000	120,000	99,000	410	35,000	140,000	124	6,600	7,400	9,200	6,000*	3,750	15,600	—	—	3,410
Comet 4B	78,600	60,400	23,900	158,000	120,000	102,500	415	34,000	140,000	128	6,650	7,450	9,300	5,950	2,972	—	—	—	2,652
Comet 4C	79,600	71,260	22,900	162,000	120,000	102,500	410	35,000	140,000	126	6,600	7,400	9,200	6,000*	3,720	11,150	—	—	2,910
Herald 100	24,220	8,640	10,290	40,000	39,500	36,000	229	22,000	38,000	90	4,480	5,800	5,250	3,765*	1,500	6,770	229	23,000	760
Herald 200	24,958	8,640	12,042	40,000	39,500	37,000	229	23,000	38,000	90	4,480	4,910	5,250	3,765	1,500	6,290	229	23,000	370
Heron 2	8,961	2,965	4,539	13,500	13,150	12,740	159	8,000	12,500	81	3,560	3,870	5,150	2,065	1,350	1,320	159	8,000	365
Jet Dragon (DH125)	—	—	—	18,000	—	—	405	30,000	—	—	—	—	—	—	2,000	—	—	—	—
Rotodyne	40,150	10,250	18,000	58,500	58,500	—	175	5,000	53,500	—	—	—	—	—	610	8,000	175	5,000	75
Trident	63,130	31,720	22,000	105,000	100,000	85,500	509	32,000	100,000	134	5,800	6,700	8,100	6,270*	2,290	11,750	459	35,000	1,330
Twin Pioneer 3	10,062	1,780	4,000	14,600	14,600	—	122	8,000	14,600	70	1,150†	—	—	1,150	662	2,500	114	5,000	100
Vanguard II	85,500	41,040	37,000	146,500	130,500	122,500	358	20,000	135,000	131.5	6,550	7,950	9,000	6,400*	2,720	20,500	356	25,000	1,590
VC10	138,500	138,000	38,000	299,000	199,000	178,000	480	42,000	240,000	122.5	7,400	8,650	9,500	6,400*	5,600	24,500	460	42,000	4,800
Super VC10	152,500	152,500	46,500	322,000	225,000	200,000	482	36,000	240,000	130	8,200	9,500	10,600	7,300*	5,600	17,050	464	40,000	4,235
Viscount 810	43,000	15,200	14,500	72,500	64,000	57,500	309	18,000	60,000	121.5	5,990	6,480	7,950	4,450*	1,530	14,300	290	24,000	1,500

* Landing field length required. † Take-off to 50 ft.

British Aircraft Industry Data Sheets . . .

Military Combat Aeroplanes

AIRCRAFT	POWERPLANT			DIMENSIONS				Crew	ARMAMENT AND EXTERNAL STORES
	No.	Type	T.-o. power (each)	Span	Length o.a.	Height o.a.	Gross wing area		
			lb. s.t.	ft. in.	ft. in.	ft. in.	sq. ft.		
Buccaneer S.1	2	Gyron Junior 101 (D.Gy.2)	7,100	42 6	62 4	16 0	—	2	Bombs (including tactical nuclear) in internal weapons bay with rotary door.
Buccaneer S.2	2	RB.168 Spey	*10,000*	42 6	62 4	16 0	—	2	Bombs (including tactical nuclear) in internal weapons bay with rotary door.
Canberra B.6	2	Avon 109 (RA.7)	7,400	64 0	65 6	15 7	960	3	2×4,000 lb. H.C. bombs (max. load); 2×250 I.G. tip tanks.
Canberra PR.7	2	Avon 109 (RA.7)	7,400	64 0	66 8	15 7	960	3	1 F.49 and 6 F.52 cameras (day); 2 F.49 cameras and 2 photo cells and 1,950 lb. photoflashes (night). Tip tanks.
Canberra B(I).8	2	Avon 109 (RA.7)	7,400	64 0	65 6	15 7	960	2	4×20 mm. Hispano; 2×1,000 lb. bombs or 16×recce. flares internal; 2×1,000 lb. bombs external.
Canberra PR.9	2	Avon 206	—	68 0	66 8	15 7	—	2	Unarmed. Cameras and photoflashes. Tip tanks.
Canberra B.15/B.16	2	Avon 109 (RA.7)	7,400	64 0	65 6	15 7	960	3	As B. Mk. 6 with two underwing 37×2-inch folding fin rocket packs.
Gannet AEW.3	1	Double Mamba 102	3,875	54 6	44 0	—	490	3	Unarmed for airborne early-warning role.
Hawker P.1127	1	Pegasus (BS.53/3)	*15,000*	24 4	49 0	10 3	—	1	Unarmed prototypes of VTOL tactical strike fighter.
Hunter F.6/FGA.9	1	Avon 203/207 (RA.28)	10,000	33 8	45 10½	13 2	349	1	4×30 mm. Aden (150 r.p.g.); 2×1,000 lb. and 2×500 lb. bombs or R.P. pods or 2×230 and 2×100 I.G. tanks.
Hunter FR.10	1	Avon 203/207 (RA.28)	10,000	33 8	46 1½	13 2	349	1	4×30 mm. Aden (150 r.p.g.); 2×230 I.G. and 2×100 I.G. tanks.
Javelin FAW.1/4/5	2	Sapphire 102/103 (ASSa.6)	8,300	52 0	56 4	16 0	928	2	4×30 mm. Aden; 2×250 I.G. ventral tanks.
Javelin FAW.2/6	2	Sapphire 102/103 (ASSa.6)	8,300	52 0	56 4	16 0	928	2	4×30 mm. Aden; 2×250 I.G. ventral tanks.
Javelin FAW.8	2	Sapphire 203/204 (ASSa.7R)	12,300	52 0	56 4	16 0	928	2	2×30 mm. Aden; 4×Firestreak AAM; 2×250 I.G. ventral tanks.
Javelin FAW.9	2	Sapphire 203/204 (ASSa.7R)	12,300	52 0	56 4	16 0	928	2	2×30 mm. Aden; 4×Firestreak AAM; 2×250 I.G. ventral tanks.
Lightning F.1/1A	2	Avon 210 (RA.24R)	14,430	34 10	50 0	19 7	—	1	2 or 4×30 mm. Aden; 2×Firestreak AAM or 48×2 in. R.P.
Lightning F.2/F.3	2	*Avon 301 (RA.34R)*	16,600	34 10	50 0	19 7	—	1	2 or 4×30 mm. Aden; 4×Firestreak AAM or 48×2 in. folding fin rockets.
Sea Hawk FGA.6	1	Nene 103	5,400	39 0	39 8	8 9	278	1	4×20 mm. Hispano; two 75 I.G. drop tanks; two 500 lb. bombs or 10×60 lb. rockets.
Sea Vixen FAW.1	2	Avon 208 (RA.24)	10,000	50 0	55 7	10 9	648	2	28×2 in. R.P.; 4×Firestreak AAM and 2×150 I.G. tanks; or bombs, R.P. or tanks in lieu of AAMs.
Scimitar F.1	2	Avon 202 (RA.24)	11,250	37 2	55 4	15 3	—	1	4×30 mm. Aden; bombs (including tactical nuclear) or 2×100 I.G. and 2×230 I.G. tanks external.
Valiant B(K).1	4	Avon 204 (RA.28)	9,500	114 4	108 3	32 2	2,362	6–7	1×10,000 lb. or 21×1,000 lb. bombs; 2×1,615 I.G. tanks.
Victor B.1	4	Sapphire 201/202 (ASSa.7)	11,000	110 0	114 11	28 1½	—	5	Internal bombs; 2 external wing tanks.
Victor B.2	4	Conway RCo.11	17,250	120 0	114 11	28 1½	—	5	Internal bombs or Blue Steel ASM; 2 external wing tanks.
Vulcan B.1/1A	4	Olympus 104 (BOl.12)	13,500	99 0	97 1	26 1	3,554	5	Internal bombs.
Vulcan B.2	4	Olympus 201 (BOl.7)	17,000	111 0	99 11	27 2	3,964	5	Internal bombs or Blue Steel ASM. Two Skybolt ALBM later.

AIRCRAFT	WEIGHTS						PERFORMANCE													
	Tare	Basic Op.	Total fuel	Max. war-load	Max. take-off	Max. landing	Max. level speed			T.-o. to 50 ft.	Landing from 50 ft.	Initial rate of climb		Service ceiling		No reserve range				Operational radius	Typical endurance
							Speed	Alt.	Wt.							With max. fuel		With max. load			
	lb.	lb.	lb.	lb.	lb.	lb.	k.	ft.	lb.	ft.	ft.	ft./min.	lb.	ft.	lb.	n. mi.	Imp. g.	n. mi.	lb.	n. mi.	hr.
Buccaneer S.1	—	—	—	—	*42,000*	—	*M.95*	—	—	—	—	—	—	—	—	*1,200*	—	—	—	—	—
Buccaneer S.2	—	—	—	—	*44,000*	—	*M.98*	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Canberra B.6	21,679	22,950	22,120	8,000	55,000	40,000	470	40,000	44,000	5,800	3,900	3,500	58,000	48,000*	36,000	3,294	2,765	2,960	8,000	1,480	7
Canberra PR.7	21,713	23,042	26,440	3,100	55,000	40,000	470	40,000	44,000	5,650	3,900	3,500	55,000	48,000*	36,000	3,820	3,305	3,717	3,100	1,858	8.5
Canberra B(I).8	23,173	26,396	22,120	5,318	56,250	40,000	470	40,000	44,000	6,000	3,900	3,400	56,250	48,000*	36,000	3,155	2,765	700†	3,318	350†	2.25†
Canberra PR.9	—	—	—	—	*58,000*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Canberra B.15/B.16	—	—	22,120	—	55,000	40,000	470	40,000	44,000	5,800	3,900	3,500	58,000	48,000*	36,000	3,294	2,765	2,960	8,000	1,480	7
Gannet AEW.3	—	—	—	—	*21,000*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hawker P.1127	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hunter F.6/FGA.9	13,270	—	—	7,400	24,000	16,750	621	36,000	—	2,250	2,550	17,500	17,750	55,000	—	1,600	1,052	—	—	500	—
Hunter FR.10	—	—	—	7,250	24,000	16,750	621	36,000	—	2,250	2,550	17,500	17,750	55,000	—	1,600	1,052	—	—	—	—
Javelin FAW.1/4/5	—	—	—	—	*35,000*	—	*M.90*	*35,000*	—	—	—	*10,000*	—	*50,000*	—	—	—	—	—	—	2
Javelin FAW.2/6	—	—	—	—	*35,000*	—	*M.90*	*35,000*	—	—	—	*10,000*	—	*50,000*	—	—	—	—	—	—	2
Javelin FAW.8	—	—	—	—	*38,000*	—	*M.94*	*35,000*	—	—	—	*12,000*	—	*60,000*	—	—	—	—	—	—	2
Javelin FAW.9	—	—	—	—	*38,000*	—	*M.94*	*35,000*	—	—	—	*12,000*	—	*60,000*	—	—	—	—	—	—	2
Lightning F.1/1A	—	—	—	—	*40,000*	—	*M1.7*	—	—	—	—	—	—	*60,000*	—	—	—	—	—	—	*1.25*
Lightning F.2/F.3	—	—	—	—	*42,000*	—	*M.2.2*	—	—	—	—	—	—	*60,000*	—	—	—	—	—	—	*1.4*
Sea Hawk FGA.6	10,300	—	—	1,000	16,200	13,300	500	10,000	15,200	5,790	4,080	5,050	15,200	—	—	—	—	—	—	250	*1.5*
Sea Vixen FAW.1	—	—	—	—	*35,000*	—	*M.90*	—	—	—	—	—	—	*50,000*	—	—	—	—	—	—	*1.5*
Scimitar F.1	—	—	—	—	*33,000*	—	*M.95*	—	—	—	—	—	—	*50,000*	—	—	—	—	—	—	*1.5*
Valiant B(K).1	75,881	77,408	51,913	21,000‡	138,000	98,000	*M.84*	30,000	110,000	4,700	5,500	4,000	140,000	54,000	140,000	3,920	9,972‡	3,000	10,000	1,500	—
Victor B.1	—	—	—	—	*160,000*	—	*M.94*	*40,000*	—	—	—	—	—	48,000*	—	—	—	—	—	—	—
Victor B.2	—	—	—	—	*200,000*	—	*M.94*	*40,000*	—	—	—	—	—	*60,000*	—	—	—	—	—	—	—
Vulcan B.1/1A	—	—	—	—	*160,000*	—	*M.94*	*40,000*	—	—	—	—	—	48,000*	—	—	—	—	—	—	—
Vulcan B.2	—	—	—	—	*200,000*	—	*M.94*	*40,000*	—	—	—	—	—	*60,000*	—	—	—	—	—	—	—

* Limited by crew survival equipment. † Typical interdictor mission at 2,000 ft. with 10 min. combat at full power over target. ‡ Overload conditions with external tanks; max. wt. 175,000 lb. All data in italics are assumed.

British Aircraft Industry Data Sheets . . .

Military Non-combat and Research Aeroplanes

AIRCRAFT	POWERPLANT No.	POWERPLANT Type	POWERPLANT T.-o. power (each)	DIMENSIONS Span	DIMENSIONS Length o.a.	DIMENSIONS Height o.a.	DIMENSIONS Gross wing area	Accommodation Crew	Accommodation Pass.	ARMAMENT STORES, ETC.
			lb.s.t. or e.h.p.	ft. in.	ft. in.	ft. in.	sq. ft.			
Argosy C. 1	4	Dart 101 (RDa.8)	2,680	115 0	89 2	27 0	1,458	4	—	Unarmed. Equipped to air-drop paratroops and supplies.
Auster AOP.9	1	Bombardier 203	180	36 5	23 8½	8 11	197.6	2	1	Unarmed. Equipment for A.O.P., casualty evacuation, photography, cable laying as required.
Auster AOP.11	1	Continental IO-470-D	260	36 5	23 8	8 11	198	3	—	Unarmed. Equipment as Auster AOP.9.
Belfast	4	Tyne R.Ty.12	5,730	158 9½	136 5	47 0	2,466	4	255	Unarmed.
Beverley C.1	4	Centaurus 173	2,850	162 0	99 5	38 9	2,916	4	94	Unarmed. Equipped to air-drop paratroops and supplies.
Bristol 188	2	Gyron Junior DGJ.10R	10,000	35 1	71 0	13 11½	396	1	—	Unarmed supersonic research with all-steel airframe.
Britannia C.1	4	Proteus 255	4,450	142 3½	124 3	37 6	2,075	7	149	Unarmed. No external stores.
Canberra T.4	2	Avon 1 (RA.3)	6,500	64 0	65 6	15 7	960	3	—	Unarmed. Provision for 2×250 l.G. tip tanks.
Canberra U.10	2	Avon 1 (RA.3)	6,500	64 0	65 6	15 7	960	(2)	—	Unarmed drone conversion of Canberra B2.
Canberra T.11	2	Avon 1 (RA.3)	6,500	64 0	69 9	15 7	960	4	—	Unarmed. A.I. nose radar. Provision for 2×250 l.G. tip tanks.
Firefly U.9	1	Griffon 74	2,045	44 6	38 3	13 2	345	(1)	—	Unarmed drone. Provision for flares.
Gannet T.5	1	Double Mamba 101	3,035	54 4	42 11	13 9	480	2	2	Internal bombs, mines, depth charges, etc.; external rockets, depth charges, sonobuoys, etc.
Gnat T.1	1	Orpheus 100 (BOr.4)	4,230	24 0	30 9	9 8	175	2	—	Unarmed. Two 59-gallon drop tanks.
Hunter T.7/T.8	1	Avon 122 (RA.21)	7,700	33 8	48 10½	13 2	349	2	—	1×30 mm. Aden (150 r.p.g.); 2×1,000 lb. and 2×500 lb. bombs or R.P. pods or 4×100 l.G. tanks.
Hunter T.66A	1	Avon 203/207 (RA.28)	10,000	33 8	48 10½	13 2	349	2	—	2×30 mm. Aden (150 r.p.g.); 2×1,000 lb. and 2×500 lb. bombs or R.P. pods or 2×100 and 2×230 l.G. tanks.
Javelin T.3	2	Sapphire 102/103 (ASSa.6)	8,300	52 0	60 2	16 0	928	2	—	4×30 mm. Aden. 2×250 l.G. ventral tanks.
Jet Provost T.3	1	Viper 102 (ASV.8)	1,750	36 11	32 5	10 2	213.7	2	—	2×0.303 m.g. (600 r.p.g.); practice bombs or R.P. on T.51 reduce performance by 30%.
Jet Provost T.4	1	Viper 200 (ASV.11)	2,500	36 11	32 5	10 2	213.7	2	—	Armament as T.51 above optional.
Lightning T.4	2	Avon 200 (RA24R)	14,430	34 10	50 0	19 7	—	2	—	2×30 mm. Aden; 2×Firestreak AAM or 48×2 in. rockets.
Meteor U.15	2	Derwent 5	3,500	43 0	41 3	13 0	374	(1)	—	Unarmed drone conversion of Meteor F.4.
Meteor U.16/U.21	2	Derwent 8/9	3,600	43 0	44 0	13 0	374	(1)	—	Unarmed drone conversion of Meteor F.8.
Short SC.1	5	RB.108	2,010	23 6	24 5	10 8	211.5	1	—	Unarmed VTOL research.
Twin Pioneer CC.1	2	Leonides 138	625	76 6	45 3	12 3	670	2	16	2×1,000 lb. bombs; para-supply packs; practice bombs on external racks.

AIRCRAFT	WEIGHTS Tare	WEIGHTS Basic Op.	WEIGHTS Total fuel	WEIGHTS Max. war-load	WEIGHTS Max. take-off	WEIGHTS Max. landing	PERFORMANCE Max. level speed Speed	Alt.	Wt.	T.-o. to 50 ft.	Landing from 50 ft.	Initial rate of climb	Service ceiling	No reserve range With max. fuel		With max. load		Operational radius	Typical endurance
	lb.	lb.	lb.	lb.	lb.	lb.	k.	ft.	lb.	ft.	ft	ft./min.	lb.	ft.	lb.	n. mi.	Imp. g.	n. mi.	lb.	n. mi.	hr.
Argosy C. 1	—	58,200	33,000†	—	97,000	92,000	—	—	—	3,500	3,600	—	—	—	—	3,200	—	600	29,000	—	—
Auster AOP.9	—	1,543	—	582	2,125	—	110	S.L.	2,125	675	600	920	2,125	—	—	208	15	—	—	—	—
Auster AOP.11	1,650	—	525	—	2,550	2,550	133	1,000	2,550	804	609	1,330	2,550	—	—	—	—	—	—	—	—
Belfast	107,185	114,000	81,200	85,000	218,000	205,000	334	22,000	140,000	6,900	4,000	1,120	218,000	30,000	170,000	5,490	10,150	1,030	85,000	—	19.25
Beverley C.1	83,000	86,000	47,450	43,000	135,000	135,000	186	15,000	100,000	3,480	2,820	700	135,000	15,700	135,000	3,000	6,590	200	45,000	1,000	17.5
Bristol 188	—	—	—	—	—	—	M2.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Britannia C.1	—	88,252	68,640	31,200	185,000	137,000	315	22,000	150,000	7,800	6,000	1,300	185,000	28,500	150,000	4,530	—	3,620	31,200	—	14.8
Canberra T.4	20,342	21,661	14,920	—	38,000	31,500	470	40,000	38,000	3,120	3,450	6,100	38,000	48,000*	31,500	2,702	1,865	—	—	1,351	6.25
Canberra U.10	—	22,441	11,016	—	34,000	—	M.78	25,000	—	2,550	—	6,500	33,000	55,000	30,000	—	—	—	—	—	—
Canberra T.11	21,464	24,381	14,936	—	46,000	40,000	470	40,000	38,000	3,120	3,450	6,100	38,000	48,000*	31,500	2,702	1,865	—	—	1,351	6.25
Firefly U.9	11,556	12,358	1,843	—	16,000	13,000	160	15,000	14,065	—	—	1,500	14,310	—	—	—	—	—	—	—	3
Gannet T.5	14,576	15,225	3,704	—	21,600	19,800	270	5,000	21,000	2,500	—	2,500	21,600	25,000	21,000	—	—	—	—	—	4
Gnat T.1	—	5,550	2,910	—	8,990	7,600	545	35,000	—	3,240	3,900	8,000	7,850	48,000	—	—	—	—	—	—	2.25
Hunter T.7/T.8	12,950	—	—	5,400	22,000	16,750	610	36,000	—	2,850	2,850	12,000	17,200	50,000	—	1,100	814	—	—	400	—
Hunter T.66A	13,150	—	—	7,100	23,500	16,750	620	36,000	—	2,250	2,550	15,000	17,600	55,000	—	1,600	1,052	—	—	500	—
Javelin T.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Jet Provost T.3	—	4,607	2,140	—	7,110	6,350	295	30,000	—	2,750	2,550	1,980	—	—	—	570	278	—	—	—	2.78
Jet Provost T.4	—	4,658	2,140	—	7,301	6,350	359	30,000	—	2,150	2,565	3,400	—	—	—	600	278	—	—	—	2.75
Lightning T.4	—	—	—	—	—	—	M2.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Meteor U.15	11,000	—	4,100	—	18,800	14,700	350	2,000	Max.	3,200	—	6,000	18,000	38,000	—	—	—	—	—	—	0.9
Meteor U.16/U.21	—	14,800	4,100	—	19,400	14,700	485	1,000	Max.	3,610	3,200	8,000	19,000	41,000	—	—	—	—	—	—	2.3
Short SC.1	—	—	—	—	7,800	7,800	—	—	—	Zero	Zero	—	—	—	—	—	—	—	—	—	—
Twin Pioneer CC.1	9,880	—	1,780	4,000	14,600	14,600	145	2,000	14,600	1,150	1,150	1,250	14,600	19,000	14,600	662	247	75	4,000	—	5.8

* Limited by crew survival equipment. † Normal; max. range given for overload fuel.

British Aircraft Industry Data Sheets . . .

Light and General Aeroplanes

AIRCRAFT	POWERPLANT			Total seats	DIMENSIONS				WEIGHTS					PERFORMANCE									
	No.	Type	T.-o. power		Span	Length o.a.	Height o.a.	Wing area	Empty	Max. fuel	Max. pay-load	Max. t.-o.	Max. land-ing	Cruising speed			T.-o. to 50 ft.	Landing from 50 ft.	Initial climb		Service ceiling		Max. range
			b.h.p.	r.p.m.	ft. in.	ft. in.	ft. in.	sq. ft.	lb.	lb.	lb.	lb.	lb.	k.	ft.	lb.	ft.	ft.	ft./min.	lb.	ft.	lb.	n. mi.
Airedale (A.109)	1	Lycoming O-360-A1A	180	2,700	36 4	26 4	10 0	190	1,630	300	1,020	2,650	2,650	117	7,500	2,650	1,200	1,140	730	2,650	14,900	2,650	912
Beagle (B.206X)	2	Continental IO-470-D	260	2,625	38 0	32 7	12 3	190	3,750	1,080	—	6,194	6,194	175	5,250	6,194	2,100	2,150	1,450	6,194	18,000	6,194	—
Beagle Miles M.218	2	Continental O-200-A	100	—	37 0	25 3	7 5	170	1,610	504	—	2,750	—	122	—	—	—	—	—	—	—	—	—
Beaver	1	P. & W. R-985	450	—	48 0	30 4	—	—	2,960	560	1,580	5,100	—	113	5,000	5,100	1,015	1,000	1,020	5,100	18,000	5,100	600
Dove 8	2	Gipsy Queen 70 Mk. 3	400	3,000	57 0	39 6	13 4	335	6,580	1,545	1,899	8,950	8,500	162	8,000	8,500	2,270	1,920	1,420	8,950	—	—	1,175
Jackaroo	1	Gipsy Major 1	120	2,100	30 4	25 5	8 10	247	1,760	—	—	2,180	—	80	3,000	2,180	—	—	500	2,180	11,000	2,180	200
Jackaroo (Agricultural)	1	Gipsy Major 1	120	2,100	30 4	25 5	8 10	247	—	—	—	2,180	—	80	3,000	2,180	—	—	500	2,180	11,000	2,180	200
Linnet	1	Continental C90-F	90	—	26 4	20 9	—	117	835	—	—	1,350	—	101	6,000	—	600*	525*	720	—	11,500	—	600
Luton Minor	1	Aeronca J.A.P. 99	37	2,250	25 0	20 0	—	125	390	52	260	650	—	65	—	600	240*	120*	450	630	—	—	160
Luton Major	1	Lycoming 55	62	—	35 4	23 9	—	163	600	88	500	1,100	—	83	4,500	1,000	240*	150*	700	1,000	—	—	300
Martlet (M.117)	1	Continental 0-200-A	100	—	37 0	25 6	7 5	170	1,095	274	—	1,550	—	100	—	—	—	—	—	—	—	—	—
Otter	1	P. & W. R-1340	600	—	58 0	41 10	13 0	—	4,368	1,282	3,220	8,000	—	111	5,000	—	1,310	975	735	8,000	17,400	8,000	755
Prospector 1	1	Lycoming GO 480	295	3,400	43 6	29 9	8 9	228	2,100	400	1,500	3,700	3,700	105	2,000	3,700	900	900	960	3,700	14,000	3,700	455
Skyvan (SC.7)	2	Continental GTS IO-520	390	3,400	64 1	38 11	13 10	373	6,030	1,080	3,000	9,300	9,300	140	5,000	9,300	1,320	1,600	1,410	8,600	2,500	8,600	800
Terrier (A.61)	1	Gipsy Major 10 Mk. 2	145	—	36 0	23 3	8 11	184	1,636	192	714	2,350	2,350	90	1,000	2,350	705	—	530	2,350	10,000	2,350	320
Turbulent	1	Ardem 4CO2	40	3,000	21 7	17 5	5 0	77.5	350	57	95	—	—	75	1,500	600	700	400	600	600	7,000	600	300

* Ground run.

Helicopters

AIRCRAFT	POWERPLANT			Total seats	DIMENSIONS				WEIGHTS				PERFORMANCE									
	No.	Type	T.-o. power (each)		Rotor dia.	Length o.a.	Height o.a.	Disc area	Tare	Fuel	Pay-load	Normal gross	Typical cruise			Initial climb		Service ceiling		Hovering ceiling		Max. range
			h.p.		ft.	ft.	ft.	sq. ft.	lb.	lb.	lb.	lb.	k.	ft.	lb.	ft./min.	lb.	ft.	lb.	ft.	lb.	n. mi.
Belvedere	2	Gazelle 100 (NGa.2)	1,650	21	48 11	89 9	17 0	1,860	11,530	1,228	6,000	19,000	120	S.L.	19,000	1,000	19,000	—	—	6,000	19,000	400
Scout	1	Nimbus	1,050	6	32 3	40 2	10 11	815	2,993	1,280	1,500	5,000	115	S.L.	5,000	2,000	5,000	20,000	5,000	17,000*	5,000	280
Wessex HAS. 1	1	Gazelle 160 (NGa.13)	1,450	14	56 0	65 9	14 3	2,460	7,600	2,430	4,000	12,600	115	S.L.	12,600	1,750	12,600	14,200	12,600	5,000	12,600	340
Wessex 2	2	Gnome H. 1200	1,250	—	56 0	65 10	15 11	2,460	7,842	2,430	5,600	13,500	115	S.L.	13,500	1,500	13,500	20,000	13,500	10,000	13,500	300
Whirlwind Srs. 1	1	P. & W. R-1340-40	600	9	53 0	59 6	15 6	2,206	4,990	1,044	2,000	7,500	80	S.L.	7,500	520	7,500	7,500	7,500	4,600*	7,500	255
Whirlwind Srs. 2	1	Leonides Major	720	9	53 0	59 6	15 6	2,206	5,375	1,044	2,000	8,000	86	S.L.	8,000	1,100	8,000	15,700	8,000	9,400*	8,000	290
Whirlwind Srs. 3	1	Gnome H.1000	1,050	10	53 0	62 4	15 6	2,206	4,694	1,450	3,406	8,000	90	S.L.	8,000	1,200	8,000	16,400	8,000	7,000	8,000	275
Widgeon	1	Leonides 521/2	500	5	49 2	57 8	13 4	1,900	4,322	600	1,000	5,900	88	—	5,900	780	5,900	12,000	5,900	4,080	5,900	260

* In ground effect.

British Aircraft Industry Data Sheets . . .

Turbine Engines

Engines		Compressor				No. of combustion chambers	No. of turbine stages	Sea level static performance									Overall dimensions			Dry weight	Power/weight ratio
								Take-off					Maximum continuous								
Make and name	Type	Type	Stages	Pressure ratio	Air mass flow			lb. th.	s.h.p.	e.h.p.	r.p.m.	lb./*/hr.	lb. th.	s.h.p.	r.p.m.	lb./*/hr.	Length of engine	Length with ex. cone	Width or height		
					lb./sec.												in.	in.	in.	lb.	*/lb. wt.
Blackburn Engines, Ltd.																					
Artouste 600	S.T.	C.	1	4.00 : 1	7.27	Ann.	2	N.A.	472	N.A.	35,000	0.98	N.A.	414	34,000	1.03	N.A.	54.0	17.5	295	1.60
Nimbus	S.T.	Ax.+C.	2+1	6.50 : 1	11.0	Ann.	2+1	N.A.	968	N.A.	35,000	0.681	N.A.	815	34,000	0.718	60.0	N.A.	20.0	390	2.15
Palouste 505	G.G.	C.	1	3.81 : 1	7.70	Ann.	2	N.A.	—	N.A.	35,000	1.26	—	N.A.	N.A.	N.A.	33.4	N.A.	17.5	214	N.A.
Bristol Siddeley Engines, Ltd.																					
Viper ASV.8 Mk. 102	Tj.	Ax.	7	4.1 : 1	32.0	Ann.	1	1,750	—	—	13,800	1.07	1,480	—	13,100	1.075	N.A.	66.98	23.4	500	3.50
Viper ASV.11 Mk. 201	Tj.	Ax.	7	4.3 : 1	44.0	Ann.	1	2,500	—	—	13,800	1.07	2,165	—	13,100	1.025	N.A.	63.997	24.55	549	4.57
Viper ASV.12	Tj.	Ax.	7	4.4 : 1	44.0	Ann.	1	2,700	—	—	13,800	1.10	2,320	—	13,100	1.055	N.A.	63.997	24.55	549	4.93
Viper ASV.20	Tj.	Ax.	8	5.1 : 1	52.8	Ann.	1	3,000	—	—	13,800	0.98	3,000	—	13,800	0.985	103.5	68.7	24.5	628	4.78
Orpheus BOr.2 Mk. 701	Tj.	Ax.	7	4.39 : 1	84.0	Cann. 7	1	4,700	—	—	10,000	1.08	4,130	—	9,500	1.06	N.A.	37.0	32.4	795	5.91
Orpheus BOr.3 Mk. 803	Tj.	Ax.	7	4.4 : 1	84.0	Cann. 7	1	5,000	—	—	10,000	1.085	4,200	—	9,470	1.07	N.A.	75.45	32.4	850	5.89
Orpheus BOr.3 Mk. 805	Tj.	Ax.	7	3.95 : 1	79.0	Cann. 7	1	4,000	—	—	9,400	1.06	4,000	—	9,400	1.06	—	75.45	32.4	850	4.71
Orpheus BOr.4 Mk. 101	Tj.	Ax.	7	4.06 : 1	84.0	Cann. 7	1	4,230	—	—	10,000	1.06	3,690	—	9,500	1.05	N.A.	77.52	32.4	900	4.70
Orpheus BOr.12	Tj.	Ax.	8	5.7 : 1	107.0	Cann. 7	2	6,810	—	—	10,000	0.967	5,825	—	9,620	0.933	N.A.	81.40	32.4	1,180	5.79
Sapphire ASSa.7R Mk. 203	Tj.	Ax.	13	7.5 : 1	168.5	Ann.	2	12,230*a*	—	—	8,600	1.38	9,310	—	8,200	0.870	N.A.	83.475	37.4	3,110	3.94*a*
Olympus BOl.12 Mk. 104	Tj.	Ax. × Ax.	7×8	10.9 : 1	195.0	Cann.	1×1	13,500	—	—	N.A.	N.A.	13,000	—	N.A.	N.A.	N.A.	156.2	42.4	3,900	3.46
Olympus BOl.7 Mk. 201	Tj.	Ax. × Ax.	5×7	N.A.	N.A.	Cann.	1×1	17,000	—	—	N.A.	N.A.	15,250	—	N.A.	N.A.	N.A.	126.4	41.6	3,950	4.28
Olympus BOl.21 Mk. 301	Tj.	Ax. × Ax.	6×7	N.A.	N.A.	Cann.	1×1	20,000	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	130.9	42.0	N.A.	N.A.
Proteus 765	Tp.	Ax. × C.	12×1	7.2 : 1	44.5	8	2×2	1,260	3,915	4,400	11,775	0.595	1,155	3,485	11,500	0.61	N.A.	100.6	40.1	2,900	1.52
Pegasus (BS.53)	L/Thrust	Ax.+Fan	2+7	N.A.	N.A.	N.A.	1+3	N.A.	—	N.A.	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	N.A.	46.5	N.A.	N.A.
BS.75	Tf.	Ax.	3+10	13.0 : 1	196	Ann.	2+2	7,550	—	—	8,900	0.508	N.A.	—	N.A.	N.A.	N.A.	89.1	35.5	1,525	N.A.
de Havilland Engine Co., Ltd.																					
Gyron Junior DGJ.2 Mk. 101	Tj.	Ax.	8	N.A.	N.A.	Ann.	2	7,100	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	—	102.9	34.4	N.A.	N.A.
Gyron Junior DGJ.10	Tj.	Ax.	8	N.A.	N.A.	Ann.	22	14,000*a*	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	70.0	191.0	32.3	N.A.	N.A.
Gnome H.1000	S.T.	Ax.	10	8.3 : 1	12.4	Ann.	2+1	143	1,050	—	19 500*e*	0.64	125	900	19,500*e*	0.67	54.8	N.A.	18.2	303*k*	3.45
Gnome H.1200 (DGe.2)	S.T.	Ax.	10	8.3 : 1	12.5	Ann.	2+1	152	1,250	—	19,500*e*	0.624	133	1,050	19,500*e*	0.64	54.8	N.A.	18.2	328*k*	3.8
Gnome P.1200	Tp.	Ax.	10	8.3 : 1	12.5	Ann.	2+1	147	1,150	—	20,000*e*	0.65	134	1,000	19,000*e*	0.68	79.3	N.A.	31.6	555	2.07
Napier Aero Engines, Ltd.																					
Eland 504	Tp.	Ax.	10	7.0 : 1	33.5	6	3	700	3,230	3,500	12,500	0.61	625	2,670	12,000	0.63	95.5	116.0	36.0	1,820	1.92
Eland E.211	S.T.	Ax.	10	7.0 : 1	33.5	6	3	550	3,500	3,710	12,500	0.60	520	2,850	12,500	0.63	135.0	N.A.	36.0	1,418	2.61
Gazelle NGa.2	S.T.	Ax.	11	6.25 : 1	16.8	6	2+1	260	1,650	1,750	20,000	0.677	190	1,210	18,600	0.711	70.0	N.A.	33.5	870	1.90
Gazelle NGa.13 Mk. 160	S.T.	Cx.	11	5.9 : 1	16.1	6	2+1	230	1,450	1,540	19,400	0.69	190	1,200	18,600	0.714	70.0	N.A.	33.5	890	1.63
Gazelle 512	S.T.	Ax.	11	6.25 : 1	16.7	6	2+1	255	1,640	1,640	19,900	0.672	195	1,280	18,800	0.697	71.5	N.A.	29.5	675*k*	2.43
Rolls-Royce, Ltd.																					
Avon RA.24R Mk. 210	Tj.	Ax.	15	N.A.	N.A.	Cann. 8	2	14,430*a*	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	126.0	41.5	N.A.	N.A.
Avon RA.29/3 Mk. 527	Tj.	Ax.	16	9.35 : 1	173.0	Cann. 8	3	11,400	—	—	8,050	0.805	9,500	—	7,750	0.748	N.A.	126.0	39.0	3,327	3.42
Avon RA.29/6 Mk. 531	Tj.	Ax.	17	10.06 : 1	185	Cann. 8	3	12,200	—	—	8,050	0.762	10,820	—	7,850	0.724	N.A.	134.0	39.0	3,471	3.52
Avon RA.29/6 Mk. 533R	Tj.	Ax.	17	10.3 : 1	185	Cann. 8	3	12,725	—	—	8,150	0.779	10,820	—	7,850	0.724	N.A.	134.0	39.0	3,471	3.68
Avon RB.146 Mk. 300	Tj.	Ax.	16	N.A.	N.A.	Cann. 8	2	16,600*a*	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	145.0	41.5	N.A.	N.A.
Conway RCo.11 (up-rated)	Tf.	Ax. × Ax.	N.A.	N.A.	N.A.	Cann. 10	N.A.	17,250	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	136.0	42.0	N.A.	N.A.
Conway RCo.12	Tf.	Ax. × Ax.	7×9	14.1 : 1	281	Cann. 10	1×2	17,500	9,980	—	9,980	0.725	14,625	—	9,590	0.69	N.A.	136.0	42.0	4,542	3.86
Conway RCo.15B	Tf.	Ax. × Ax.	7×9	14.3 : 1	295	Cann. 10	1×2	18,500	9,895	—	9,895	0.701	15,000	—	9,500	0.667	N.A.	136.0	42.0	4,582	4.05
Conway RCo.42/1 Mk. 540	Tf.	Ax. × Ax.	4+3×9	14.6 : 1	365	Cann. 10	1×2	20,250	—	—	9,955	0.622	16,500	—	9,575	0.592	N.A.	150.0	48.0	5,001	4.04
Conway RCo.42/3 Mk. 541	Tf.	Ax. × Ax.	4+3×9	14.6 : 1	227	Cann. 10	1×2	21,800	—	—	—	—	—	—	—	—	—	—	45.0	5,100	—
RB.145	Tf.	Ax.	N.A.	N.A.	N.A.	Ann.	N.A.	2,750	—	—	N.A.	N.A.	N.A.	—	N.A.	N.A.	N.A.	63.7	20.8	N.A.	N.A.
Spey 505 (RB.163)	Tf.	Ax. × Ax.	4×12	16.8 : 1	202	Cann. 10	2×2	9,850	12,490	—	12,490	0.560	9,450	—	12,260	0.545	N.A.	110.0	37.0	2,200	4.48
													e.h.p.								
Dart RDa.3 Mk. 506	Tp.	C.	2	5.4 : 1	20.5	7	2	—	1,345	1,480	14,500	0.755	*1,188*	1,075	13,800	0.816	N.A.	95.0	38.0	1,026	1.5
Dart RDa.6 Mk. 510	Tp.	C.	2	5.4 : 1	20.5	7	2	—	1,535	1,675	14,500	0.717	*1,432*	1,310	14,000	0.753	N.A.	98.0	38.0	1,106	1.64
Dart RDa.6 Mk. 511	Tp.	C.	2	5.4 : 1	20.5	7	2	—	1,535	1,650	14,500	.0725	*1,650*	1,535	14,500	0.725	N.A.	98.0	38.0	1,106	1.64
Dart RDa.6 Mk. 514	Tp.	C.	2	5.4 : 1	20.5	7	2	—	1,535	1,650	14,500	0.725	*1,650*	1,535	14,500	0.725	N.A.	98.0	38.0	1,114	1.62
Dart RDa.7 Mk. 520	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,630	1,815	15,000	0.726	*1,655*	1,495	14,500	0.736	N.A.	98.0	38.0	1,207	1.5
Dart RDa.7/1 Mk. 525	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,730	1,910	15,000	0.706	*1,750*	1,585	14,500	0.721	N.A.	98.0	38.0	1,227	1.56
Dart RDa.7/2 Mk. 526 and 527	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,835	2,020	15,000	0.690	*2,020*	1,835	15,000	0.690	N.A.	98.0	38.0	1,227	1.65
Dart RDa.7/2 Mk. 528	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,835	2,020	15,000	0.690	*2,020*	1,835	15,000	0.690	N.A.	98.0	38.0	1,223	1.66
Dart RDa.7/2 Mk. 529	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,910	2,100	15,000	0.710	*2,100*	1,910	15,000	0.710	N.A.	98.0	38.0	1,227	1.71
Dart RDa.7/2 Mks. 530 and 531	Tp.	C.	2	5.6 : 1	23.5	7	3	—	1,835	2,020	15,000	0.690	*2,020*	1,835	15,000	0.690	N.A.	98.0	38.0	1,227	1665
Dart RDa.10	Tp.	C.	2	6.35 : 1	27	7	3	—	2,305	2,555	15,000	0.663	*2,555*	2,305	15,000	N.A.	98.0	38.0	38.0	1,376	1.86
Dart RDa.10/1 Mk. 542	Tp.	C.	2	6.35 : 1	27	7	3	—	2,750	3,030	15,000	N.A.	*2,555*	2,305	15,000	0.663	N.A.	98.0	38.0	1,376	2.2
Tyne RTy.1 Mk. 506	Tp.	Ax. × Ax.	6×9	13.5 : 1	46.5	Cann. 10	1×3	—	4,320	4,785	15,250	0.505	*4,190*	3,835	13,500	0.505	N.A.	108.7	43.2	2,275	2.11
Tyne RTy.11 Mk. 512	Tp.	Ax. × Ax.	6×9	13.5 : 1	46.5	Cann. 10	1×3	—	4,850	5,325	15,250	0.482	*4,670*	4,270	14,100	0.488	N.A.	108.7	43.2	2,275	2.34
Tyne RTy.12 Mk. 515	Tp.	Ax. × Ax.	6×9	13.5 : 1	46.5	Cann. 10	1×3	—	5,095	5,500	15,250	0.466	*5,050*	4,685	14,500	0.472	N.A.	108.7	43.2	2,177	2.53
Tyne RTy.20	Tp.	Ax. × Ax.	6×9	13.5 : 1	46.5	Cann. 10	1×3	—	—	5,855	15,250	—	—	—	—	—	—	108.7	43.2	2,205	—
Tyne RTy.22	Tp.	Ax. × Ax.	6×9	13.5 : 1	46.5	Cann. 10	1×3	—	—	7,075	—	—	—	—	—	—	—	108.7	43.2	2,279	—
Rover																					
TP.90	Tp.	C.	1	—	—	1	1	120	—	—	47,000	—	100	—	47,000	1.36	35.5	—	19.9	200	1.67

Note.—Take-off thrusts and powers quoted for Rolls-Royce turbojets and turboprops are minimum figures; maximum continuous e.h.p.s are shown in italics because residual thrusts are not quoted. Abbreviations.—Ann., annular; Ax., axial; C., centrifugal; Cann., cannular; G.G., gas generator; N.A., not available; S.T., shaft-turbine engine; Tf., turbofan; Tj., turbojet; Tp., turboprop; * lb. thrust, s.h.p., e.h.p. or g.h.p. as applicable to respective type of engine; *a* with afterburner; *c*, e.h.p.; *e*, power turbine r.p.m.; *k*, without reduction gears.

British Aircraft Industry Data Sheets . . .

Piston Engines

Engine Make and name	Type	No. of cyls.	Dimensions: Swept volume	Length	Width	Height	Dry weight	Comp. ratio	Performance: Take-off b.h.p.	Take-off r.p.m.	Max. continuous b.h.p.	Max. continuous r.p.m.	Max. continuous ft.	Fuel consumption
			cu. in.	in.	in.	in.	lb.		b.h.p.	r.p.m.	b.h.p.	r.p.m.	ft.	g.p.h.
Alvis, Ltd.														
Leonides 514/8A	R.	9	718.6	54.4	41.5	41.5	815	6.5 : 1	550	3,000	495	2,900	3,750	23.5
Leonides 521/2*	R.	9	718.6	54.96	41.5	41.5	820	6.5 : 1	500	3,000	405	2,800	8,250	25.0
Leonides 531/8	R.	9	783.3	54.4	43.0	43.0	855	6.5 : 1	640	3,200	590	3,000	2,750	26.0
Leonides 554/1*	R.	9	783.3	32.8	43.0	43.0	790	6.5 : 1	625	3,200	590	3,000	2,750	26.0
Leonides Major 755/1*	2R.	14	1,117.8	54.9	38.9	38.9	1,065	6.8 : 1	770	2,900	695	2,900	7,500	47.5
Leonides Major 702/1	2R.	14	1,117.8	62.06	38.9	38.9	1,200	6.8 : 1	875	3,000	750	2,900	5,500	34.0
Blackburn Engines, Ltd.														
Bombardier 702/208	I.L.	4	398	45.9	18.6	31.5	375	7 : 1	180	2,600	155	2,300	1,250	10.5
Bristol Siddeley Engines, Ltd.														
Centaurus 661	2R.	18	3,270	74.6	55.3	55.3	3,460	7.2 : 1	2,625	2,800	2,265(M) 2,110(S)	2,500(M) 2,500(S)	5,500(M) 12,000(S)	85.0
de Havilland Engine Co., Ltd.														
Gipsy Queen 70 Mk. 3	I.L.	6	622	71.75	19.56	33.23	708	6.5 : 1	400	3,000	355	2,700	4,250	17.5
Gipsy Queen 30 Mk. 2	I.L.	6	622	61.5	19.59	32.99	525	6.5 : 1	250	2,500	250	2,500	S.L.	13.5
Gipsy Major 215*	I.L.	4	416	51.0	16.8	29.8	415	7.25 : 1	215	2,850	207	2,700	S.L.	10.3

Abbreviations.—I.L., in-line; (M), medium supercharger speed; N.A., not available; (S), fast supercharger speed; S.L., sea level; R., radial; *, helicopter engine.

Rocket Engines

Engine Make and name	Duty	No. of comb. chamb.	Propellents: Oxidant	Fuel	Coolant	Max. thrust	Propellent supply means	Normal firing time	Overall dimensions: Length	Width	Dry weight
						lb.		sec.	in.	in.	lb.
Bristol Siddeley Engines, Ltd.											
PR-37	D.B.	1	H.T.P.	Kerosene	H.T.P.	170	Compressed nitrogen	A.T.	N.A.	N.A.	N.A.
Gamma Mk. 201	M.P.	4	H.T.P.	Kerosene	H.T.P.	19,000	Turbo-pumps	A.T.	38.0	36.0	700
Gamma Mk. 301	M.P.	4	H.T.P.	Kerosene	H.T.P.	N.A.	Turbo-pumps	A.T.	N.A.	N.A.	N.A.
Scentor BSSt.1	M.P.	2	H.T.P.	Kerosene	H.T.P.	N.A.	Turbo-pumps	A.T.	N.A.	N.A.	N.A.
de Havilland Engine Co., Ltd.											
Spectre D.Spe.5	A.F.	1	H.T.P.	Kerosene	H.T.P.	8,000	Turbo-pumps	A.T.	56.5	24.0	431
Spectre D.Spe.4	A.T.O.	1	H.T.P.	Kerosene	H.T.P.	8,000	Turbo-pumps	A.T.	59.2	21.5	N.A.
Double Spectre D.Spe.D.1	A.F./M.P.	2	H.T.P.	Kerosene	H.T.P.	16,000	Turbo-pumps	A.T.	58.6	36.6	N.A.
Napier Aero Engines, Ltd.											
Triple Scorpion	A.F./M.P.	3	H.T.P.	Kerosene	H.T.P.	7,000–9,000	Turbo-pumps	A.T.	35.0	21.5	295
Double Scorpion	A.F./M.P.	2	H.T.P.	Kerosene	H.T.P.	4,000–6,000	Turbo-pumps	A.T.	35.0	23.0	216.4
Single Scorpion	A.F./M.P.	1	H.T.P.	Kerosene	H.T.P.	2,000–3,000	Turbo-pumps	A.T.	35.0	16.5	140
Rolls-Royce											
RZ.2	M.P.	1	L.O.	Kerosene	Kero-sene	137,000	Turbo-pumps	A.T.	N.A.	N.A.	N.A.

Abbreviations.—A.F., Aircraft flight rocket engine; A.T., according to tank capacity; A.T.O., assisted take-off unit; D.B., drone booster; H.T.P., high-test hydrogen peroxide; M.P., missile powerplant; M.T., missile trimmer engine; N.A., not available; °, chamber only.

Ramjets

Make and name	Duty	Fuel	Performance: Thrust	Speed	Height	Consumption	Dimensions: Length	Diameter	Dry weight
			lb.		ft.		in.	in.	lb.
Bristol Siddeley Engines, Ltd.									
Thor BT.2	M.P.	Kerosene	*16,500*	M=3	S.L.	N.A.	91.5	15.75	N.A.
BSRJ.824	M.P.	Kerosene	N.A.	N.A.	N.A.	N.A.	N.A.	18.0	N.A.

Abbreviations.—A.F., Aircraft flight ramjet engine; M.P., Missile powerplant; N.A., not available; S.L., Sea level. Data in italics are estimated.

Missiles and Research Vehicles

Missile Prime Contractor and Name	Type	Status	Powerplant	Guidance	Length	Weight	Speed	Max. range
					ft. in.	lb.	Mach No	miles
Armstrong Whitworth Seaslug Mk. 1	SAM	Prod.	1×I.C.I. (S.P.); 4 S.P. wrapped boosters	B-R. (G.E.C.)	19 8	N.A.	N.A.	N.A.
Avro Blue Steel	ASM	Dev.	1 Bristol Siddeley Stentor BSSt. 1 twin-chamber rocket engine (L.P.)	In. (Elliott)	35 0	*15,000*	*1.6*	*100+*
Bristol Aerojet Meteorological Rocket	Met.	Dev.	1×S.P.	None	7 6	N.A.	N.A.	40 alt.
Bristol/Ferranti Bloodhound Mk. 1	SAM	Opl.	2×Bristol Siddeley Thor (Rj); 4×S.P. wrapped boosters	Semi-active homing (Ferranti)	25 0	N.A.	N.A.	*60+*
de Havilland Blue Streak	SB1	Dev.	2×150,000 lb.s.t. Rolls-Royce RZ.2 rocket engines (L.P.)	—	65 4	207,600	8,500 m.p.h.	N.A.
de Havilland Firestreak Mk. 1	AAM	Opl.	S.P.	I-R.	10 5½	300	2.0+	4+
de Havilland Red Top	AAM	Dev.	S.P.	I-R.	N.A.	N.A.	3.0+	8
English Electric Blue Water	SSM	Dev.	S.P.	In.	N.A.	N.A.	N.A.	*70+*
English Electric Thunderbird Mk. 1	SAM	Opl.	1×S.P.; 4×S.P. wrapped boosters	Semi-active homing (Marconi)	20 8	N.A.	N.A.	N.A.
Malkara, (Australian Government Aircraft Factories)	Anti-tank	Prod.	2-st. S.P.	Wire Cd.	6 3½	206	400 m.p.h.	2
Pye Python	Anti-tank	Dev.	2-st. Bristol-Aerojet (S.P.)	Wire Cd.	5 0	80	N.A.	N.A.
Skylark (upper-air research vehicle)		Opl.	1×12,000 lb.s.t. Raven (S.P.)+optional 20,000 lb.s.t. Cuckoo booster	None	25 0 (no booster)	2,560 (no booster)	5.0	100–180 alt.
Short Seacat	SAM	Dev.	2-st. S.P.	Radio Cd.	*4 10*	N.A.	N.A.	N.A.
Short Seacat Mk. 2	SAM	Dev.	2-st. S.P.	Radio Cd. (?)	*6 6*	N.A.	1.0+	N.A.
Short Tigercat	SAM	Dev.	2-st. S.P.	Radio Cd.	*5 0*	N.A.	N.A.	N.A.
Vickers Vigilant	Anti-tank	Dev.	2-st.I.C.I. (S.P.)	Wire Cd.	1 11½	31	*350* m.p.h.	1
Westland Black Knight (re-entry research vehicle)		Opl.	1×16,400 lb.s.t. B.S. Gamma	Const. heading auto pilot/ radio beam	35 0	N.A.	N.A.	500 alt
Westland Black Knight (two-stage)		Opl.	1×16,400 lb.s.t. B.S. Gamma+1×S.P.		40 0	N.A.	10,000 m.p.h.	370 alt.

Abbreviations.—B.R., beam-riding; Cd., command; Dev., under development; In., inertial; I-R., infra-red; L.P., liquid-propellent; N.A., not available; Opl., operational; Prod., in production, not yet opl.; Rj., ram-jet; SB1, space booster, first stage; S.P., solid propellent; st., stage; s.t., static thrust. Data in italics are estimated or approximate.

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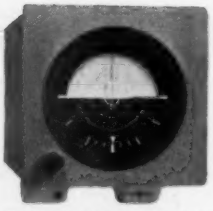
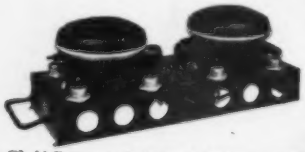


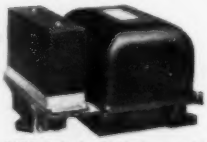
Roller-blind Director/Horizon

Machmeter

Vertical Speed Indicator



Twin CL.11 Rotorace ® Azimuth Reference Unit



VGL.2 Attitude Reference Unit

Sperry Gyros form the heart of the Trident's attitude display system. CL.11 Rotorace ® Directional Gyros provide the azimuth references; VGL.2 Vertical Gyros supply precise attitude information to the roller-blind director/horizons designed for de Havilland's new jetliner. Sperry also manufacture the Trident's Air Speed Indicators, Vertical Speed Indicators and Machmeters.

Altogether the Sperry Team is contributing 18 functional instruments to the overall Smiths/Sperry consortium project.

The Trident is one of many important aspects of Sperry's aeronautical work. The company is currently engaged on navigation, guidance, and control problems for VTOL and Helicopters, as well as fixed-wing aircraft: these offer long-term interest to electronic and electro-mechanical engineers and designers, on stable platforms, auto-stabilizers, auto-pilots and instrumentation. If you feel you would like to play a part in

solving tomorrow's problems today

SPERRY

. . . we invite you to discuss your place in projects of this nature at any of the Sperry establishments with KEITH STONEMAN, BRACKNELL. Tel: 1301

SPERRY Gyroscope Company Limited

BRENTFORD (Middx.) BRACKNELL (Berks.)

WHAT TO SEE AT FARNBOROUGH

A Guide to the Indoor and Outside Stands

On this and the following 17 pages will be found a guide to the exhibits on the stands in the static exhibitions at Farnborough. The exhibitors are listed alphabetically with their stand numbers; the initials O.D.S. indicate the outside display sites, R.D.S. the radar demonstration sites, and M.P. the missile park. A six-page directory of non-exhibitors follows this section.

MAJOR EXHIBITS

Aircraft

Armstrong Whitworth Argosy C.1; Avro Vulcan B.2; Avro 748; Blackburn Buccaneer S.1; Beagle A.109 Airedale; Beagle B.206; Beagle A.61 Terrier; Beagle AOP.11; de Havilland Comet 4; de Havilland Dove 8; de Havilland Heron; English Electric Lightning T.4; Flight Refuelling Meteor U.16; Folland Gnat Trainer; Gloster Javelin with Gyron Junior DGJ.10 turbojets; Handley Page Victor B.2; Handley Page Herald; Handley Page H.P.115; Hawker Hunter Trainer; Hunting Jet Provost T.4; Scottish Aviation Twin Pioneer 3; Short SC.1; Westland Wessex HAS.1; Westland Rotodyne; Westland Belvedere; Westland Scout; Westland Gnome Whirlwind 3.

Powerplants

Alvis Leonides Major Series 750 helicopter engine; Alvis Leonides 531; Alvis Leonides 554 helicopter engine; Blackburn Astazou; Bristol Siddeley Pegasus lift/thrust ducted fan; Bristol Siddeley Olympus; Bristol Siddeley Orpheus 803; Bristol Siddeley Viper 20; Bristol Siddeley Proteus 705; Bristol Siddeley Gamma; Bristol Siddeley Stentor; Bristol Siddeley Thor BT-1 ramjet; Bristol Siddeley PR37 Rocket boost unit; de Havilland Gnome H.1000; de Havilland coupled Gnome H.1200; de Havilland Gnome P.1000 turbo-prop; de Havilland Gyron Junior DGJ.2; M.o.A. solid propellent rocket motor; Napier Gazelle; Napier Eland; Rolls-Royce Conway R.Co.42 mock-up; Rolls-Royce Spey; Rolls-Royce Tyne R.Ty.11; Rolls-Royce RB.108; Rolls-Royce RB.145; Rolls-Royce O-200A, O-300 and IO-470D Continental piston engines.

Missiles

Armstrong Whitworth Seaslug; Avro Blue Steel; Bristol/Ferranti Bloodhound; de Havilland Firestreak; de Havilland Red Top; de Havilland Blue Streak; English Electric Thunderbird; English Electric Blue Water; (Fairey) Jindivik 2B target drone; (Fairey) Malkara anti-tank missile; M.o.A. Jaguar test rocket; Vickers Vigilant anti-tank missile; Short Seacat.

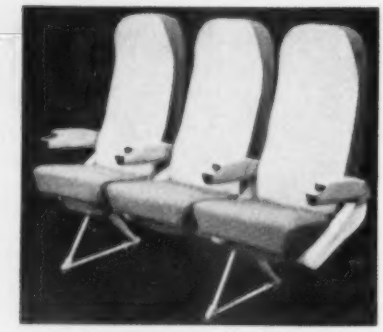
Guide to the Static Displays . . . .

Accles and Pollock, Ltd. (129). Exhibits comprise precision cold drawn tubing; seamless tubing in steel, steel alloy, stainless steel, titanium, titanium alloys, zirconium, zircaloy 11, tantalum, vanadium, niobium and molybdenum; special thin-walled, helically convoluted flexible tubing and joints; machined and honed bore tubes; and a display of non-destructive testing equipment.

Acton Bolt, Ltd. (247). Products include aircraft bolts and screws to standard specifications.

Aero Controls, Ltd. (71). Manufacturers of A.R.B.-approved A.C. flex couplings for pipe lines and Acflex Flightweight flexible couplings for rigid pipe lines.

Aircraft Furnishing, Ltd. (279). A feature of this stand is the company's Lonsdale 300 series aircraft passenger seat.



Produced by Aircraft Furnishing, this Lonsdale 300 series passenger seat is fitted in a number of transport types.

Aircraft Materials, Ltd. (262). Products include the Pop and Imex ranges of rivets; parachute, ejector-seat and helicopter rescue-harness fittings; supply dropping equipment including dereefing devices.

Airmed, Ltd. (145). On display is a comprehensive range of telecommunication headsets, microphones, miniature amplifiers and test equipment, together with a selection of oxygen masks and breathing apparatus for high-altitude aircraft.

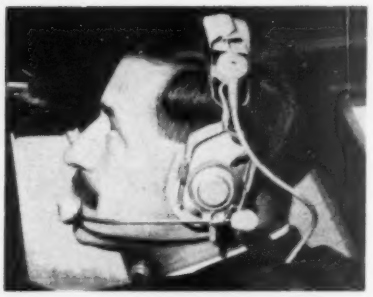
The Airscrew Co. and Jicwood, Ltd. (200). Display includes a 6.8-in. axial-flow fan cooling unit of the kind to be used in the Short Belfast; a two-stage 12-in. axial-flow fan for Belvedere; a 4.5-in. high-efficiency backward aerofoil centrifugal fan for VC10 windscreen demisting; and a 6.8-in. radial cooling fan similar to those installed in the Avro 748 and Comet. The centrepiece of the exhibits is a cut-away working model of a 6¼-in. dia. cooling fan for the Wessex engine oil system.

Airtech, Ltd. (O.D.S. X). Products cover Aircon transportable containers; electronic equipment; Tubelock polythene tube fittings; component sub-assemblies and jigs.

Alcan Industries, Ltd. (189). Major prominence is given to stress-relieved aircraft aluminium plate production and the company's new 144-in. hot mill at its Rogerstone Works. Two large exhibits draw attention to Alcan facilities for the production of die and hand forgings; Noralduct heat exchanger plate is also featured.

Alvis, Ltd. (H). The exhibits on this stand comprise the Leonides Major Series 750 powerplant, as fitted to the Whirlwind; the long-stroke Leonides 554 suitable for the Sycamore or, without a clutch and fan, for the Widgeon; and a sectioned Leonides 531, as used in the Twin Pioneer.

Amalgamated Wireless (Australasia), Ltd. (23). See Marconi's Wireless Telegraph Co., Ltd.



A production model of the new Amplivox Amplilite headset which was shown in prototype form last year.

Amphenol-Borg, Ltd. (289). Exhibits include new Series 48 connectors to MIL-C-26500; a miniaturized high-temperature connector specially designed for military use having removable, crimpable contacts in a number of shell sizes and contact arrangements; three new miniature connectors for 12, 19, or 38 ways; miniature 17 Series rack and panel connectors with removable contacts; and a miniature AN range in two physical sizes and six contact arrangements.

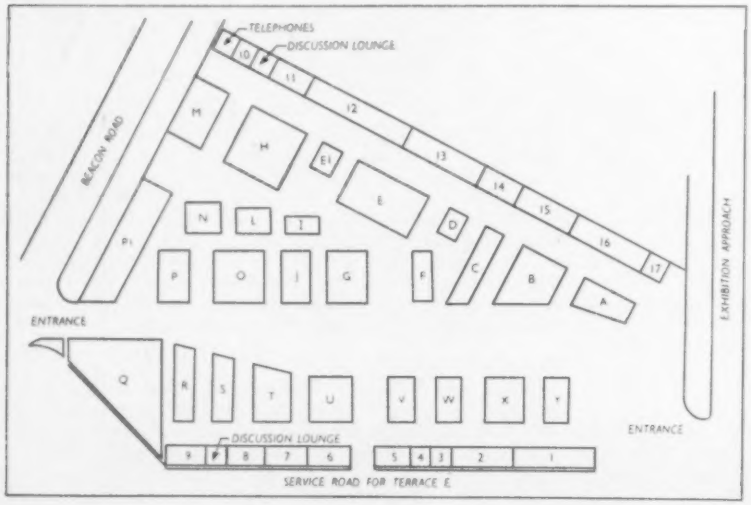
Amplivox, Ltd. (277). New products on display are the Amplilite lightweight headset weighing less than 15 oz.; a headband ear defender; the 15050 Jetlite boom microphone headset weighing less than 7 oz.; the 15700 aircrew hand microphone specified by B.E.A. for the Trident; and an encapsulated amplifier weighing ½ oz.

Sir W. G. Armstrong Whitworth Aircraft, Ltd. (O.D.S. P1). See Hawker Siddeley Aviation, Ltd.

Associated Electrical Industries, Ltd. (197, 198 and O.D.S. L). A diagrammatic layout on one side of the stand shows the principal components of a DC power system for aircraft; a similar layout on the other side illustrates

OUTDOOR DISPLAY SITES

Company	Stand No.
Airtech, Ltd.	X
Sir W. G. Armstrong Whitworth Aircraft, Ltd.	P1
Associated Electrical Industries, Ltd.	L
Auto-Diesels, Ltd.	3 and W
Automotive Products Co., Ltd.	N
Blackburn Engines, Ltd.	8 and T
The British Oxygen Co., Ltd.	11 and H
Brown Brothers (Aircraft), Ltd.	7
David Brown Industries, Ltd.	D
A.C. Cossor, Ltd.	16
Delaney Gallay, Ltd.	6
Dexion, Ltd.	13 and E
Export Packing Service, Ltd.	P
Flight Refuelling, Ltd.	4
Gloster Aircraft Co., Ltd.	8 and S
H.M.L. (Engineering), Ltd.	1 and Y
Houchin, Ltd.	17 and A
Lucas Gas Turbine Equipment, Ltd.	15 and B
Lucas Rotax, Ltd.	15 and B
M.L. Aviation Co., Ltd.	G
Marconi Instruments, Ltd.	C
Marston Excelsior, Ltd.	V
Microcell, Ltd.	12 and E1
Ministry of Aviation	2
Morfax, Ltd.	U
Murex Welding Processes, Ltd.	I
The Pyrene Co., Ltd.	F
Rellumit (London), Ltd.	J
Rotax, Ltd.	15 and B
Rover Gas Turbines, Ltd.	14
Short Brothers and Harland, Ltd.	O
Spurling Motor Bodies, Ltd.	10 and M
L. M. Van Moppes & Sons (Diamond Tools), Ltd.	5
W. Vinten, Ltd.	9 and R
Zwicky, Ltd.	Q



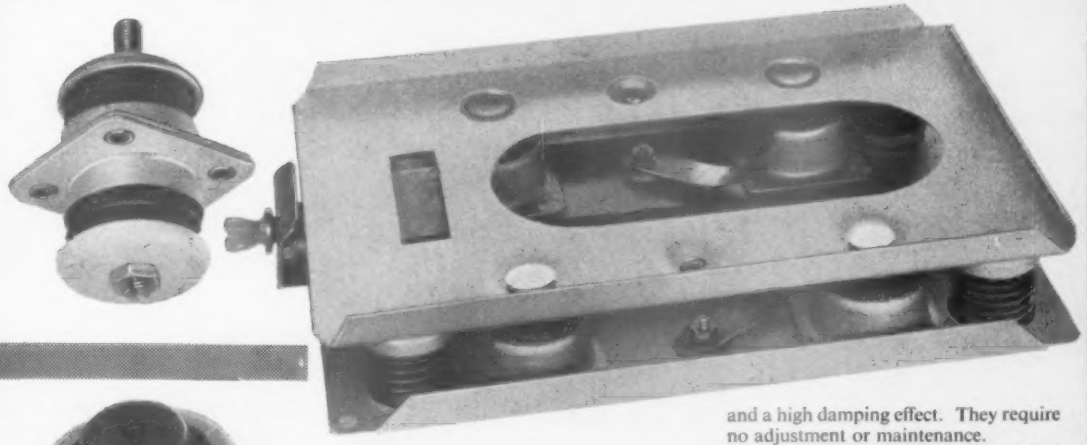
NEW from Delaney Gallay

ALL METAL

VIBRASHOCK ISOLATION

Vibration Control Systems

On Stands 6 & 285 at Farnborough this year



Delaney Gallay will be showing this year a new and fully developed type of all-metal vibration control system, designed to protect delicate equipment from vibration and shock.

These units are small, lightweight and accommodate both axial and radial motion. They have a wide load tolerance and a high damping effect. They require no adjustment or maintenance.

The basic principle of Vibrashock Isolation can be applied in an endless variety of ways to protect virtually any piece of equipment however mounted. We are actively engaged in engineering systems for the aircraft industry and shall be glad both to tell you about our work and discuss your needs.

Thermal Insulation Blankets
Heat Exchangers
Oil Coolers
Water Extractors
Toilet Units

GIVE GENEROUSLY
R.A.F. BENEVOLENT FUND
67 PORTLAND PLACE
LONDON, W.1.

We shall also be showing:

Welding Machines
Examples of Flux bath brazing
Vacuum furnace brazing
Special Welding techniques

Flow Turning

All on Stands

6 (Equipment display)
and 285 (Main Exhibition)

where you will be very welcome

Delaney Gallay LTD

Vulcan Works, Edgware Road,
London, N.W.2.
Telephone: GLAdstone 2201

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GRAVINER

FIREWIRE Triple FD

The optimum aircraft fire and overheat detector

DEMONSTRATION AT

STAND 219

S.B.A.C. FARNBOROUGH

* Another first by Graviner
* Responds only to temperature rise
* Will not alarm if accidently short circuited
* Uses standard FIREWIRE elements
* World wide availability
* System manufactured in U.S.A. by FENWAL, ASHLAND, MASSACHUSETTS

REG TRADE MARK GRAVINER

Fenwal

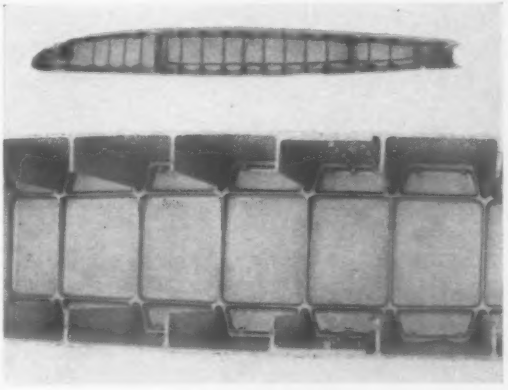
GRAVINER · COLNBROOK · SLOUGH · BUCKS · TELEPHONE: COLNBROOK 2345

GI6

Guide to the Static Displays . . . .

those of an AC power system. Both layouts include all the equipment required in a single generating channel up to the main busbars. Associated with each power system layout are examples of DC and AC equipment and components suitable for use in either type of system. Other exhibits include ignition equipment; transistorized airport intercom. equipment; a mobile steam generating unit for energizing low-pressure aircraft engine turbine starters; and the Mazda visual glide-path indicator system.

B. Attewell and Sons, Ltd. (98). Laminated shim specialists, this company is displaying laminated aluminium, brass and steel; aircraft Perspex tableware entirely fabricated from sheet; and vacuum-formed components such as wing-light covers, toilet fittings and boxes.



A wing assembly built by Blackburn Aircraft using components machined from Noral stress-relieved plate produced by Alcan Industries.

Auto Diesels, Ltd. (O.D.S. 3 and W). Manufacturers of aircraft ground starting and servicing equipment: gas turbine and air starters; engine handling trolleys.

Automotive Products Co., Ltd. (53 and O.D.S. N) and **Lockheed Precision Products, Ltd.** (54). On the combined stand is a wide range of components for the Trident, Gnat and Beagle aircraft. These include Airedale nose oleo leg; Beagle 206 main and nose landing gear, complete with retraction system and flap actuator; Trident nose undercarriage leg, main and nose retraction jacks; and Gnat Trainer aileron servo. Outside there are PurOlator bulk-refuelling filters and filter-separators.

Trials with the A.W.A. Seaslug ship-board SAM have been made from H.M.S. "Girdle Ness."

An Avro Blue Steel test vehicle leaving a Valiant during tests at Woomera.

Avdel, Ltd. (243). Products on display comprise Huckbolts, Jo-bolts, the Chobert riveting system, Pip pins and riveting clamps.

Avery-Hardoll, Ltd. (255). Products cover aviation fuelling equipment including bulk-meters, refuellers and hydrant dispensers; quick-release self-sealing couplings; and automatic bottom loading units.

Avica Equipment, Ltd. (280). The full product-range of piping and ducting system components designed and produced by the company is on show. These include Type W metallic flexible pipes; gimbal-type flexible joints; Flexflyte lightweight flexible ductwork; and bellows, expansion joints and valve seals.

Bakelite, Ltd. (42). Exhibits include phenolic foam, a recently developed light-weight thermal insulator; polyester resins; aluminium alloy sheet surfaced with Warerite decorative laminated veneers; and printed circuits based on copper-clad Bakelite laminate.

Baxter, Woodhouse and Taylor, Ltd. (95). Manufacturers of electrically heated flying clothing and pressure suits; pressure helmets; special fabrics; sound and heat insulation materials; and flexible ducting.

B.B. Chemical Co., Ltd. (168). This stand covers the diverse range of Bostik products used by the aircraft industry.

Beaufort (Air-Sea) Equipment, Ltd. (162). See P. Frankenstein and Sons (Manchester), Ltd.

Belling and Lee, Ltd. (268). Exhibit includes further developments of the Camlecon and Collecon electrical connectors for aircraft and missiles; new Filtron interference suppressors; and additions to several other ranges of equipment.

Bell's Asbestos and Engineering, Ltd. (36). Exhibits include numerous improved versions of established products which incorporate recently introduced synthetic materials, such as fire-seals with improved silicone sponge cores and asbestos fabric covers proofed with Viton "A" to satisfy recent demands for increased temperature and Skydrol resistance.

Bell Precision Engineering Co., Ltd. (239). Jigs and fixtures for the aircraft industry, together with lost-wax moulds.

Beme Telecommunications, Ltd. (80). Products include ground VHF target aircraft tele-control installations; airborne VHF receivers; and target camera timing equipment.

Birmetals, Ltd. (178). Examples of aircraft sheet and strip together with a typical range of extruded sections available for use by the aircraft industry in all D.T.D. specifications. A special feature of the stand is the products from the company's new Sendzimer Mill.

Birmingham Aluminium Casting (1903) Co., Ltd. (204). Castings by the sand, gravity die and pressure die processes in aluminium and magnesium alloys to B.S. specifications, including the latest magnesium-zirconium-thorium alloys.

Blackburn Engines, Ltd. (O.D.S. T and 8). See Hawker Siddeley Aviation, Ltd.

James Booth Aluminium, Ltd. (232). Emphasis on this stand is placed on the company's increased capacity for plate, sheet and strip as a result of new rolling plant which has been installed at its Kitts Green Works. Exhibits include Duralumin alloy products, large aircraft forgings produced on a 12,000-ton press, and examples of the numerous and diverse extruded sections manufactured by the company.

Boulton Paul Aircraft, Ltd. (N). Stand illustrates the wide variety of work undertaken by the company. Radiating from a model of a factory a number of arms display models and photographs depicting some of the various aspects of current projects. Exhibits fall broadly into three categories: major airframe components; hydraulics, including powered flying control units; and electronic equipment.

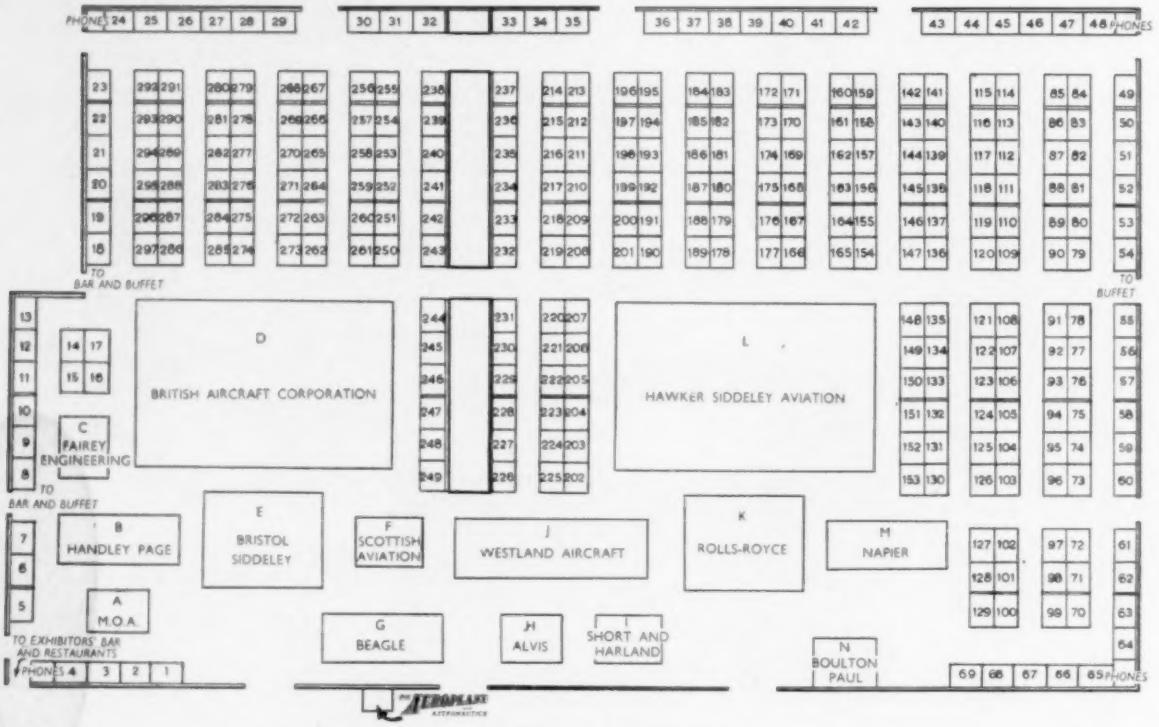
An Avica 2-in. inside diameter twin-gimbal flexible joint.

B.P. Trading, Ltd. (220). See Shell-Mex and B.P., Ltd.

Brent Chemical Products, Ltd. (263). The products of this company cover crack detection processes, paint removers, engine-cleaning compounds and electrical cleaning compounds.

Bristol Aerojet, Ltd. (282). Activities of this company include the design, development and production of solid-propellent motors for guided missiles, flight-test and research vehicles. Several examples of this type of work are on display.

Guide to the Static Displays . . . .



PRINCIPAL EXHIBITORS

Company	Stand No.
Alvis, Ltd.	H
Boulton Paul Aircraft, Ltd.	N
Bristol Siddeley Engines, Ltd.	E
British Aircraft Corporation, Ltd.	D
British Executive and General Aviation, Ltd.	G
Fairey Engineering, Ltd.	C
Handley Page, Ltd.	B
Hawker Siddeley Aviation, Ltd.	L
Ministry of Aviation	A
D. Napier and Son, Ltd.	M
Rolls-Royce, Ltd.	K
Scottish Aviation, Ltd.	F
Short Brothers and Harland, Ltd.	I
Westland Aircraft, Ltd.	J

Bristol Aeroplane Plastics, Ltd. (113). A range of aviation equipment and components in reinforced plastic materials, including a 100-gallon asbestos-reinforced, phenolic drop tank; glass-fibre laminated ducting; fluted-core radomes; and the Epoch pipe system.

Bristol Siddeley Engines, Ltd. (E). Exhibits include the Pegasus lift/thrust ducted-fan engine; the Olympus with reheat; the Orpheus 803 and Viper 20 turbojets; the Proteus 705 turboprop; Gamma and Stentor rocket engines; Thor BT-1 ramjet; and the PR-37 rocket boost unit.

British Aircraft Corporation, Ltd. (D, 293 and M.P.). These displays feature all of the Corporation's civil and military activities with special emphasis on the B.A.C. One-Eleven and the Vigilant anti-tank missile. In the missile park Thunderbird, Bloodhound and Blue Water are on show and there is an airfield demonstration of Blue Water and deployment of a Thunderbird battery. Stand emphasis is on the high level of B.A.C. engineering craftsmanship.

The British Aluminium Co., Ltd. (170). The principal item on this stand is a left-hand side panel for the cowling for the Rolls-Royce Conway. It has been four-way stretch-formed from 6-ft. wide 20 s.w.g. D.T.D. 710A sheet supplied by British Aluminium to Park Ward (Aircraft), Ltd. This compound contour is an excellent example of the use to which the company's recently introduced new quality sheet for stretch-forming purposes is being put.

British Communications Corporation, Ltd. (163). Activities include the development of communications and magnetic-recording equipment and electronic measuring apparatus; VHF ground equipment; flight-deck broadcasting systems.

British Ermeto Corporation, Ltd. (213) Products include Ermeto high-pressure pipe couplings in mild steel, stainless steel, light alloy and brass; and high-pressure valves in mild steel, stainless steel and bronze.

British Executive and General Aviation, Ltd. (G). Exhibits on this stand comprise a furnished mock-up of the cabin of the five-seat Beagle B.206 twin-engined executive aircraft; a furnished cabin mock-up of the Beagle-Miles M.218 twin-engined Gemini replacement; and the fuselage of the Beagle-Auster A.109 Airedale four-seat light executive and touring aircraft.

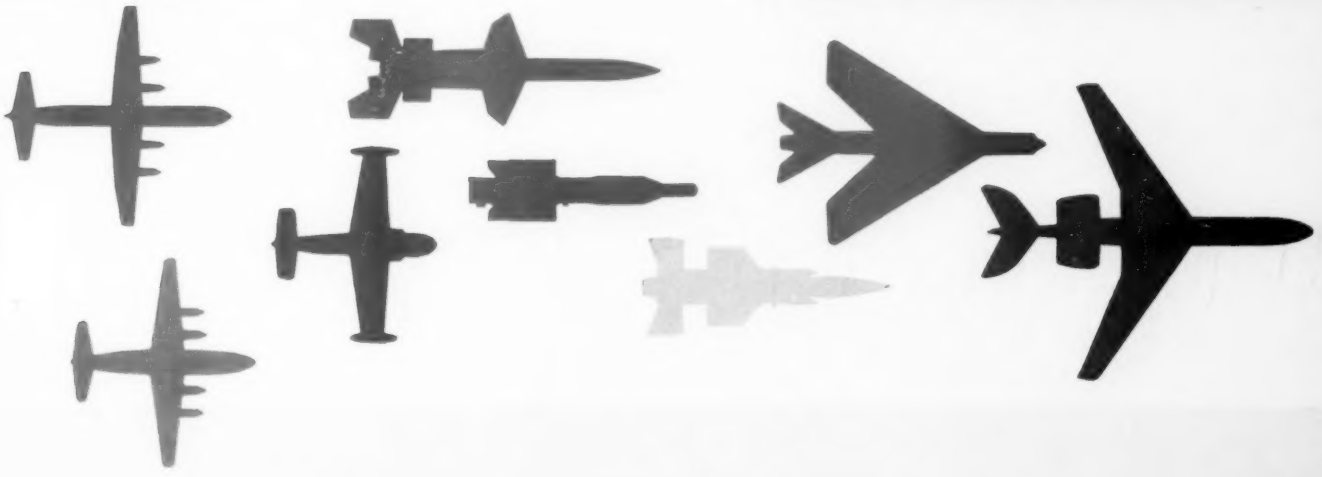
British Insulated Callender's Cables, Ltd. (201). A wide range of standard and specialized cables and accessories which emphasize the increasing application of these products in the fields of civil and military aircraft and in guided missile development. The latest variants of the following generic types of aircraft wiring cables are displayed: Efglas, which is insulated with a matrix of glass fibres and P.T.F.E.; PVC-insulated Nyvin; phase-marked Tersil; Pren; and Unifiredet 7 and Unifire F12.

British Manufactured Bearings Co., Ltd. (131). This company is exhibiting its complete range of miniature precision ballraces for gyroscopic and high-temperature applications, together with pressurized assembly cabinets.

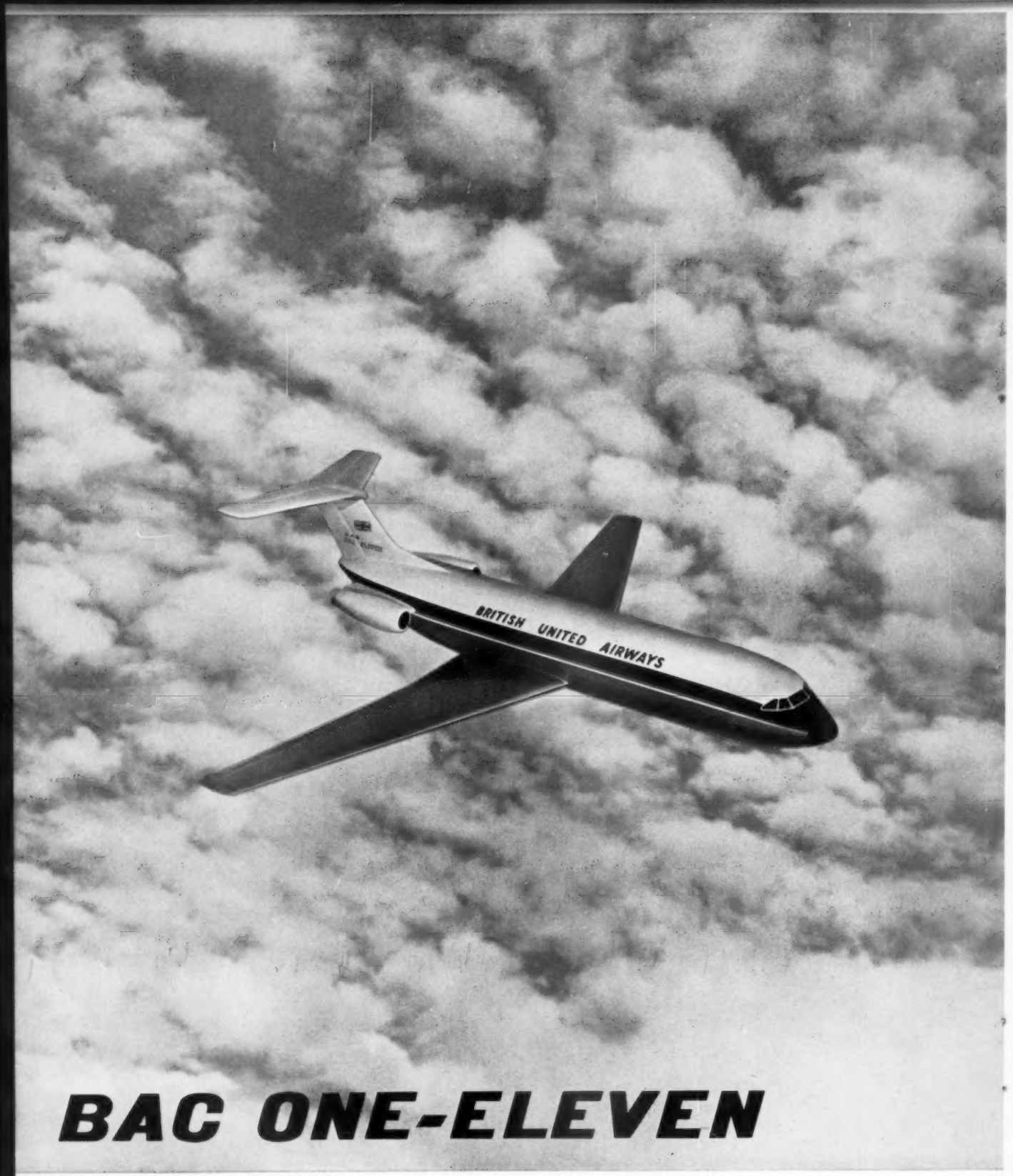
First orders for the B.A.C. One-Eleven short-haul transport have come from British United Airways.

The new force in world aviation

BRITISH AIRCRAFT CORPORATION



VISCOUNT	SUPERSONIC AIRLINER PROJECT	JET PROVOST
VANGUARD	T-188	BLOODHOUND
VC 10—SUPER VC 10	CANBERRA	THUNDERBIRD
BAC ONE-ELEVEN	LIGHTNING	VIGILANT
BAC 107	TSR-2	BLUE WATER



BAC ONE-ELEVEN

The short haul jet successor to the Viscount

. . . and built by

BRITISH AIRCRAFT CORPORATION

VC10 & SUPER VC10

The Clean Wing shape of the future

...and built by

BRITISH AIRCRAFT CORPORATION

TGA BVC30

LIGHTNING

Chosen for defence by the Royal Air Force

...and built by

BRITISH AIRCRAFT CORPORATION

TGA 861.14A

Chosen for defence by the Royal Air Force,

by Australia, by Sweden and by Switzerland

...and built by

BRITISH AIRCRAFT CORPORATION

BBS.1

The new surface-to-surface missile

being developed for the British Army

...and built by

BRITISH AIRCRAFT CORPORATION

BWS.1

Publicly proven as the world's most accurate

and reliable infantry anti-tank weapon

...and built by

BRITISH AIRCRAFT CORPORATION

Chosen by the Royal Air Force, by Ceylon and by Sudan

...and built by

BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1 ENGLAND

TGA BHP108

Guide to the Static Displays . . . .

British Oxygen Co., Ltd. (210–212 and O.D.S. 11 and H). Activities cover the design and manufacture of a comprehensive range of liquid oxygen breathing systems and equipment, including emergency passenger systems; liquid nitrogen fuel-tank explosion suppression systems; and liquid oxygen ground-handling equipment for use on airfields.

British Paints, Ltd. (215). New exhibits on display include some small specimens illustrating the PR–1730 Viton rubber-based sealant for high-temperature work up to 230°C. for long service and 360°C. for short periods; the PR–1560 polyurethane coating for the interior of tanks and fuselages; and the PR–1500 series polyurethanes based on cold-moulding rubbers. Panels are shown illustrating the chemical etching of metals.

Britten-Norman, Ltd. (88). Exhibits on this stand fall into two categories: Mincronair rotary atomizer spray equipment for agricultural aircraft, and models and photographs of the CC–1 and CC–2 Cushioncraft.

S. G. Brown, Ltd. (85). This company is demonstrating the Gyrotwin, the latest version of the Master Dynamic Reference System for aircraft. Its predecessor, the Master Reference Gyro, is already in wide-scale service in R.A.F. and R.N. aircraft. The Arma Brown gyroscopic compass, suitable for use in helicopters and hovercraft, is on display, together with a selection of headphones, telephones, precision gears and potentiometers.

Left, the Beagle-Auster A.O.P. Mk.11 is basically an A.O.P.9 re-engined with a 260-h.p. Continental.

Left, first flight of the 2-3 seat Beagle-Miles M.117 is planned for the summer of 1962.

Brown Bayley Steels, Ltd. (83). Products cover forged and rough-turned rings; black-rolled descaled and bright-ground bar; stainless steel sheet in various finishes.

Brown Brothers (Aircraft), Ltd. (203 and O.D.S. 7). Standard parts to A.G.S., B.S., and S.B.A.C. specifications are displayed, together with Hi-Shear pins and collars, Oddie stiff nuts, and special machined parts and aircraft metals. In addition to the standard range of B.B.A. Aerojacks of 3- to 40-ton capacity, power-operated jacks for Comet, Vanguard, VC10, Boeing 707 and DH. 121 are exhibited outside.

David Brown Industries, Ltd. (O.D.S. D). The company's 950 Turbo Taskmaster aircraft-towing tractor with redesigned superstructure makes its début in the outdoor exhibition. In particular, the styling of the radiator and bonnet have been changed in a manner which gives the tractor both a pleasant and purposeful appearance.

Bryans Aeroquipment, Ltd. (90). Exhibits comprise a high-precision pressure control and calibration system with particular application for air data system testing; data handling and plotting system; a new dual tachometer tester complete with transistorized tuning fork; and servo-operated digital read-out, exhaust-gas temperature indicators.

Burgess Products Co., Ltd. (287). Products include exhaust and cabin blower silencers, air cleaners, aircraft-cabin sound-proofing, precision switches for aircraft and ground application, and vibro tools for engraving.

Burndept, Ltd. (84). Display includes the BE.256 five channel transmitter receiver with remote control; the BE.255 five-channel transmitter receiver; the BE.281 UHF/VHF Power Meter; kalium batteries and nickel cadmium secondary cells; and the BE.300 intercom. amplifier which can be used in aircraft with or without radio.

Canadian Marconi Co. (19). See Marconi's Wireless Telegraph Co., Ltd.

Cellon, Ltd. (202). The theme of this stand is 50 years of progress in aircraft finishes. Range includes heat, ester lubricant and hydraulic-fluid resistant finishes for the protection of aircraft and guided missiles and resistant coatings for crop-spraying aircraft. Specialities available are Birlon strippable coatings, Celloseel anti-corrosive jointing compound and Cellon component materials for chemical contour processing.

Cementation (Muffelite), Ltd. (209). On display is the Barrymounts range of air damped isolators and shock mounts. Some of the activities of the company's environmental testing laboratory are also featured.

Above, the David Brown 950 Turbo Tugmaster aircraft-towing tractor with a restyled superstructure designed to give the unit a more purposeful appearance.

CIBA (A.R.L.), Ltd. (114). The main features of this display comprise examples of Redux and Hidux bonding, the uses of Araldite epoxy resins in the aircraft industry, and Aeroweb metal honeycomb materials for lightweight structures.

E. K. Cole, Ltd. (193). A.R.B.-approved transistor inverters, including the Type E.210 fully transistorized single-phase instrument. A range of single and three-phase static inverters for the generation of close-tolerance 115V 400 c/s AC power from 24V DC supply is also exhibited.

Largest of the Beagle range announced to date is the 5-7 seat Beagle-Masefield B.206 designed for executive operations.

Chelton (Electrostatics), Ltd. (169). Display of aerial systems, equipment and static dischargers. Erection of typical aerial system demonstrated. Recent developments include a mat aerial, high-speed mast antistatic fairings, insulated and open-wire terminations.

The Chesterfield Tube Co., Ltd. (270). Products include seamless steel and light-alloy gas cylinders for airborne and ground installations; precision seamless steel rocket-motor tubes; extrusions in ferrous and rare metals; beryllium tubes and rods; alloy-steel undercarriage tubes.

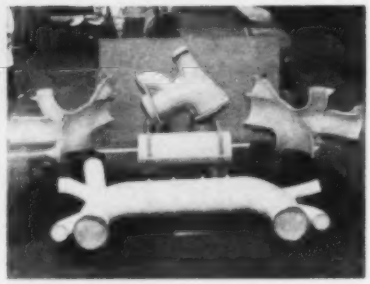
J. S. Chinn and Co., Ltd. (276). Manufacturers of aircraft and engine components and assemblies fabricated from titanium, Nimonic stainless steel, aluminium and magnesium alloys.

Chloride Batteries, Ltd. (286). A wide range of batteries for all purposes in the aircraft industry are featured on this stand. They include units for aircraft, guided missile, transistorized equipment and emergency lighting applications.

Two 100-h.p. Continentals will give the Beagle-Miles M.218 four-seater a cruising speed of 150 m.p.h.

Guide to the Static Displays . . . .

Bestobell flanged and reinforced connectors and bellows manufactured by Bell's Asbestos and Engineering.



Bristol Aeroplane Plastics aircraft ducting in reinforced plastics.

Connolly Bros. (Curriers), Ltd. (18). Leather for upholstery and panelling and general furnishing of aircraft and for furniture and decoration of airports and terminal buildings.

Coopers Mechanical Joints, Ltd. (57). Exhibits include gaskets in copper and asbestos, and steel; fuel and lubricating strainers; corrugated gaskets for high-temperature sealing in stainless steel and Nimonic steel; shims in various metals including laminated brass and laminated aluminium; washers in folded copper, steel and copper asbestos; and resin-bonded cork joints.

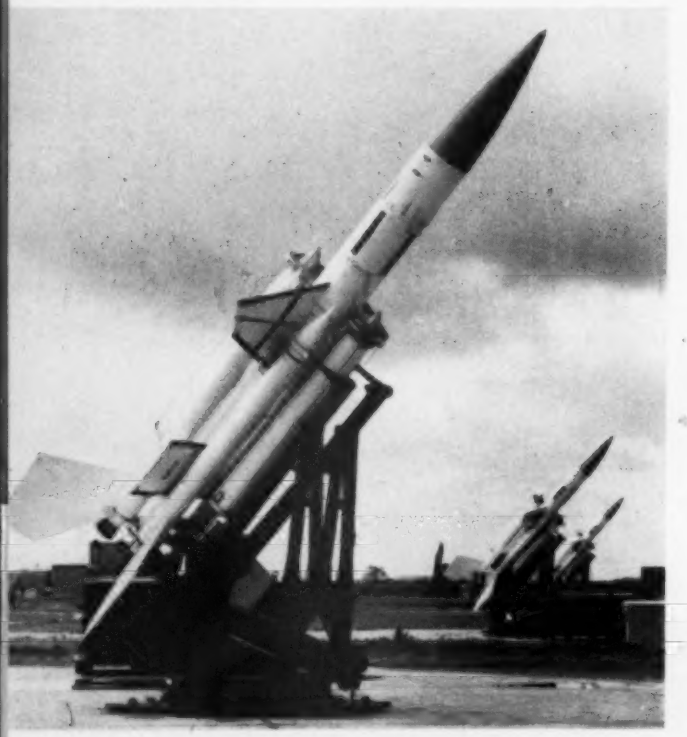
A. C. Cossor, Ltd. (240 and O.D.S. 16), and **Cossor Radar and Electronics, Ltd.** (241). Exhibits of this group of companies include secondary surveillance radar system components; printed waveguides; quartz delay lines; aircraft VOR/ILS installation field test sets; lightweight airborne VOR/ILS equipment; a range of oscilloscopes; transistorized VHF pocket receivers.

John Curran, Ltd. (195). In addition to the company's existing range of aero-engine test equipment, this stand has an overall artist's impression of the new J Mk. 2A turbojet test stand designed to suit the requirements of the Royal Navy, where the test facilities already consist of a J Mk. 1A and J Mk. 1B stands.

Darchem Engineering Co., Ltd. (267). Manufacturers of high-temperature lightweight insulation material in cloth, batt, cleeving, cordage and tape.

The Decca Navigator Co., Ltd. (74). Equipment on this stand comprises the company's Omnitrac lightweight airborne digital computer for use with undistorted Decca Flight Log charts; a self-setting Flight Log; and Mk. 8, 9 and 10 Decca receivers.

Decca Radar, Ltd. (75 and R.D.S.). The principal exhibit comprises a transistorized radar display-system drive complex embodying a new concept in high-stability transistor circuit engineering. Other Decca developments include the automatic remote data-printing unit for use with Type WF.2 wind-finding radar; an automatic printing system for recording radar information; and two new meteorological radars, Types 43 and 44.



Left, the Bristol/Ferranti Bloodhound SAM system, in either its Mk. 1 or 2 versions, has been ordered by Australia, Sweden, and Switzerland as well as by the R.A.F.

Delaney Gallay, Ltd. (285 and O.D.S. 6). On show for the first time is the Vibrashock-Isolation all-metal vibration and shock-control systems. Other exhibits include examples of high-temperature insulation blankets; multi-entry air-to-air heat exchangers; high-density high-performance coolers; anti-icing heat exchangers.

Desoutter Brothers, Ltd. (249). On display is a complete range of tools, including drills, screwdrivers, nutrunners, grinders, rivet and bolt millers, nibblers and shears, a number of which are available for working demonstration. In addition, a selection of pneumatic cylinders and controls from Lang Pneumatic, Ltd., and photographs of machinery produced by Carter Stevens (Automation), Ltd., are featured.

Dexion, Ltd. (O.D.S. 13 and E). Design and construction of servicing docks, storage racks, fixed and mobile staging, etc., employing slotted angle.

"Diamond H" Switches, Ltd. (140). Hermetically sealed relays for aircraft application, including the Series BR four-pole, double-throw electro-magnetic switch units suitable for DC operation, and the Series BS relays designed to give good reliability on dry circuit applications.

Didsbury Engineering Co., Ltd. (116). Manufacturers of Mimilift aircraft and missile servicing systems ranging from 2½- to 25-cwt. capacity, and the Servicer lifting and transporting truck.

Docker Brothers. (250). With the theme of "paints for the aircraft industry," this exhibit covers a comprehensive range of fully approved surface coatings to M.o.A. and A.R.B. requirements for use on aircraft as well as surface coatings for airport buildings, maintenance of vehicles and road transport and a general range of industrial finishes.

Dowty Group, Ltd. (43-48). A wide selection of civil and military aircraft accessory equipment, including a new hydraulically operated vibrator; fuel flow proportioners and engine synchronizing components; ram air turbine and turbo alternator; a range of V/STOL equipment; Hovercraft lift fans and fuel pumps; aircraft aud missile fuel system components; undercarriage control switches and indicators; and precision seals, glands and mouldings in various rubbers.

Dunlop Rubber Co., Ltd. (59). Aviation products include aircraft tyres, wheels and brakes; pneumatic components; de-icing equipment; range of compressors for the ground charging of pneumatic systems; inflatable seals for protecting jet-engine intakes; and a range of collapsible rubberized fabric containers.

Dzus Fastener Co., Ltd. (146). Range of Dzus fasteners including the self-ejecting type; supersonic and general-purpose fasteners. Of particular interest is the tension fastener and the panel-mounting fastener and strip.

H. W. Edghill and Co., Ltd. (137). Products include aircraft servicing, operational and production-line equipment.

Ekco Electronics, Ltd. (194). The company's standard E.190 airborne weather radar in single and dual form is on display, together with a new development in the form of a transistorized Doppler drift unit which can be installed optionally with the E.190 as an aid to navigation.

Electro-Hydraulics, Ltd. (68). This stand includes an historical display of products, ranging from the Halifax to the Belfast. Hydraulic components for a range of operating temperatures and fluids are also exhibited.

Elliott Brothers (London), Ltd. (253, 254 and R.D.S.). For the first time the whole range of Elliott activities in the field of aviation are demonstrated. Special features include the application of the company's 803 digital computer to various aeronautical subjects; the VERDAN airborne digital computer; automatic throttle control; flight control computers; automatic landing units for the VC10; a true mass flow meter; Doppler radar navigation system; VHF communications equipment; and aircraft relays and servo components.

AEI POWER FOR FLIGHT

...GENERATES PROGRESS

'Switch on!' . . . AEI power is meeting all the electrical needs of modern flight. The design and development of new equipments by AEI has been a vital part of the electrifying progress made by man in the air. AEI equipped the first aircraft to use an electrical power system, produced the first constant frequency a.c. supply system, and developed the first oil-lubricated brushless alternator. Today AEI generators, alternators, motor-generators, inverters and amplidynes supply the power needs of all types of aircraft, whilst development of power systems for future flight projects is backed by AEI's entire research laboratory resources.

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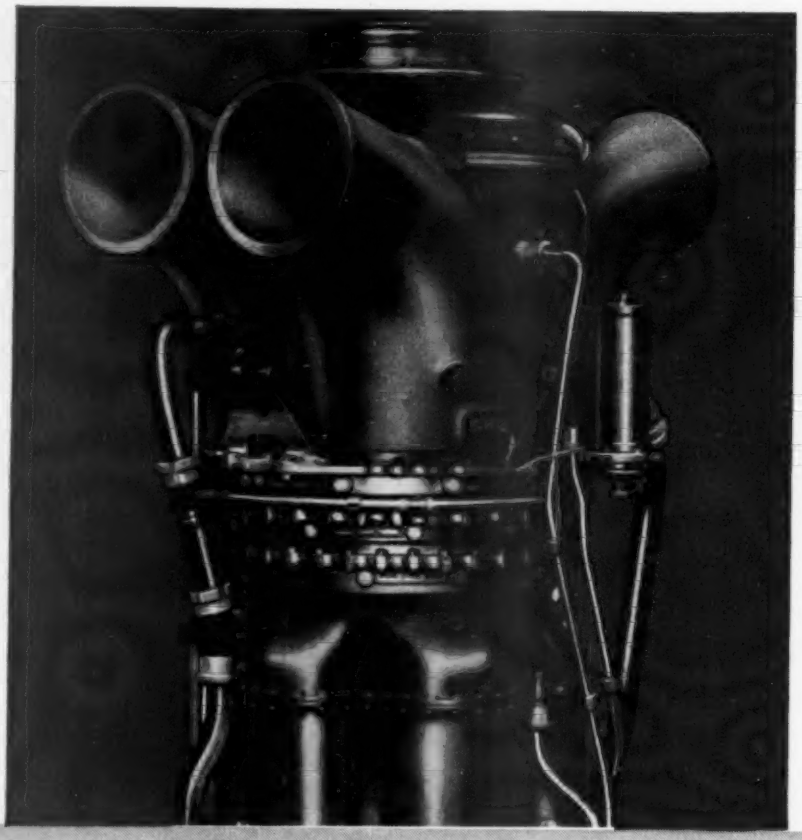
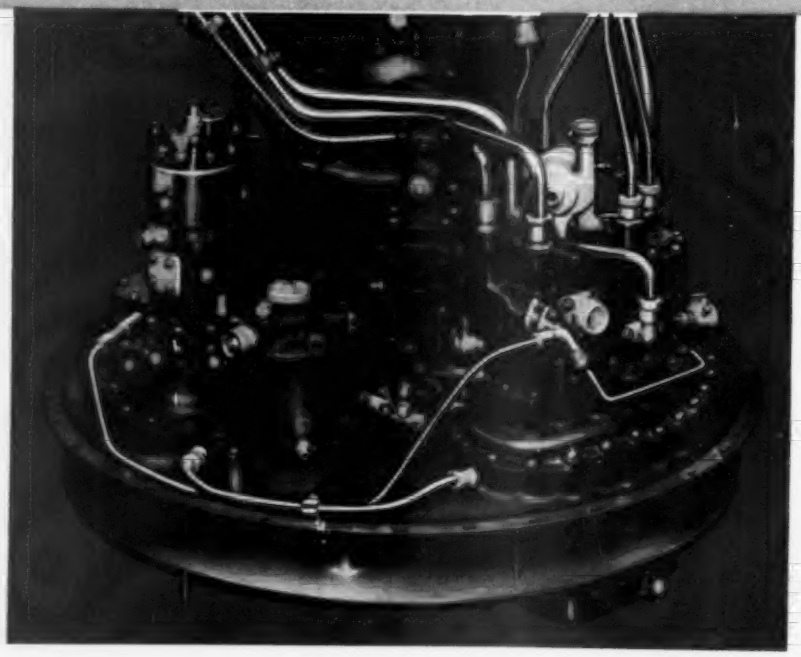
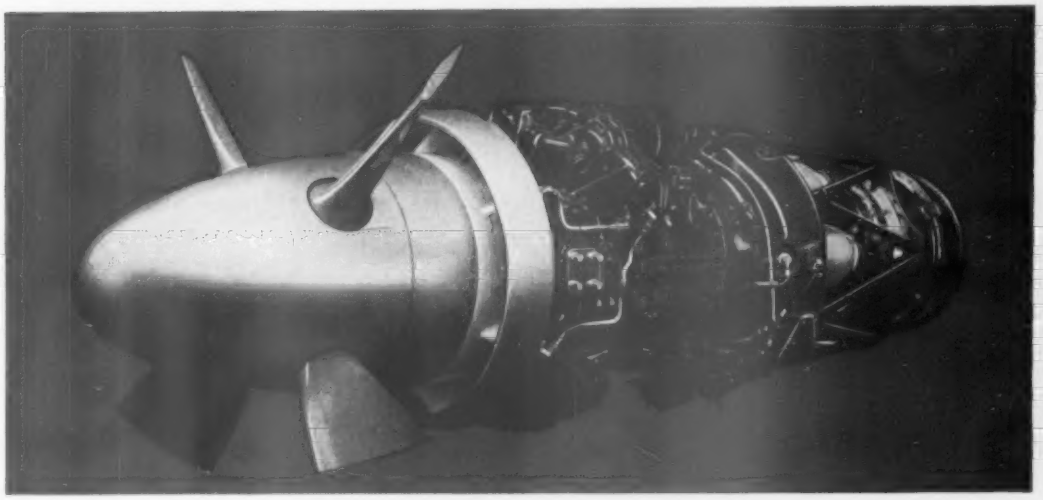


Napier Gazelle – for helicopters

The Gazelle free turbine engine (1,260-2,000 s.h.p.). The ease with which it meets emergency demands has earned it a tremendous international reputation.

NAPIER AERO





Napier Eland – for short-haul operation

The Eland propeller-turbine is designed for new airliners and for conversion of piston-engined aircraft.

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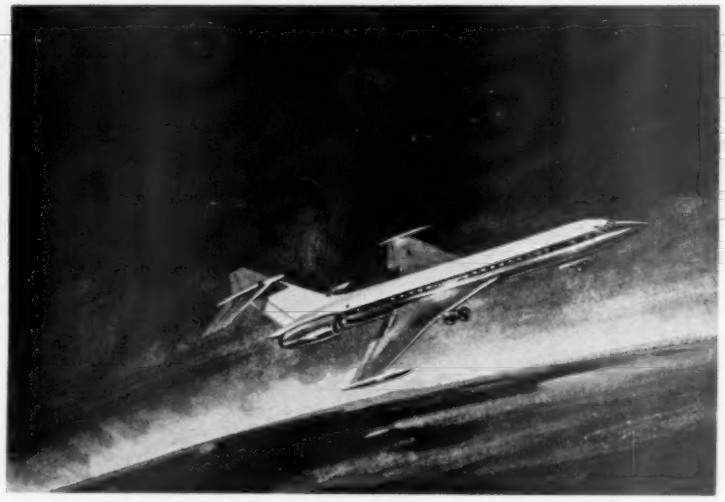
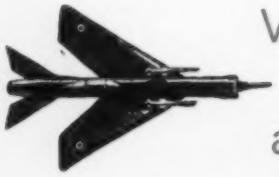
ELLIOTT AUTOMATION

A new concept in Flight Control



Barely a generation ago two young brothers transformed a dream into reality at Kittyhawk. Today supersonic flight and regular round-the-world schedules are already taken for granted. We are even approaching the time when it will be possible to direct the whole of a commercial aircraft's flight from its point of arrival—even though take-off may be thousands of miles away.

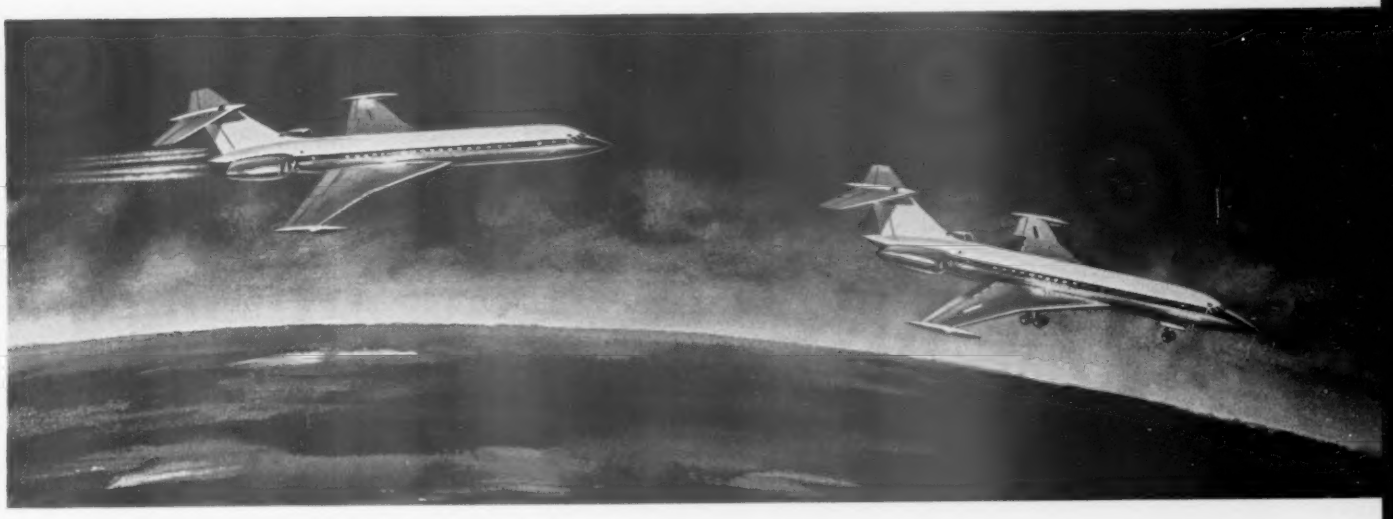
Such an achievement demands sophisticated equipment—tried and tested under all conditions. Elliotts alone are in a position to provide all the necessary equipment from within one group. Very soon Elliotts will transform this dream into reality with an achievement which, a generation hence, will likewise be taken for granted—as indeed are all great achievements.

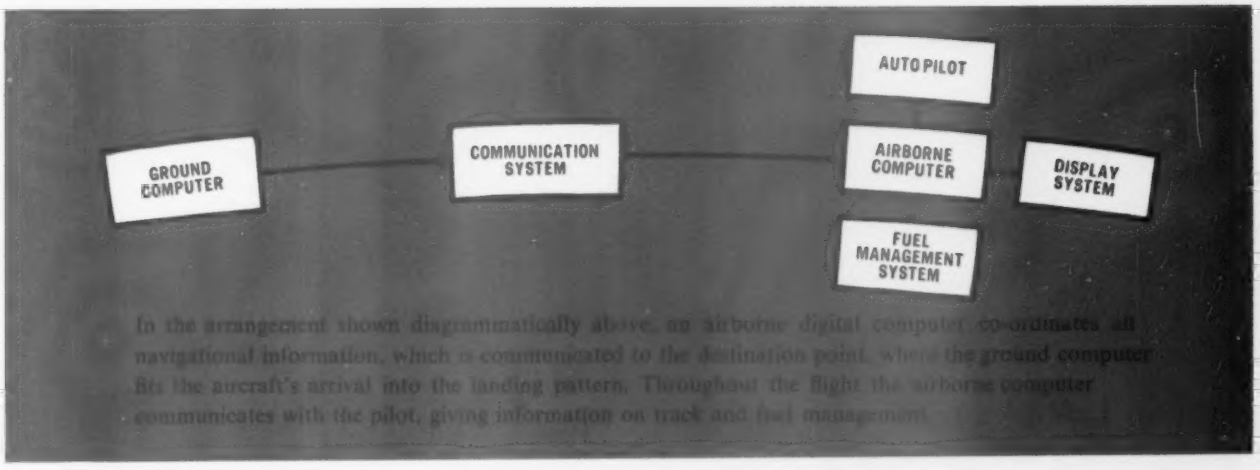


Visit our Stands 253/254 at FARNBOROUGH

Elliott Brothers (London) Limited invite you to visit Stands 253 and 254 at Farnborough. In the Radar area outside the Exhibition Tent there will also be a Special Demonstration of some of the many different uses of an Elliott general purpose digital computer in the world of aviation.

... take-off to touch-down





In the arrangement shown diagrammatically above, an airborne digital computer co-ordinates all navigational information, which is communicated to the destination point, where the ground computer fits the aircraft's arrival into the landing pattern. Throughout the flight the airborne computer communicates with the pilot, giving information on track and fuel management.

ELLIOTT

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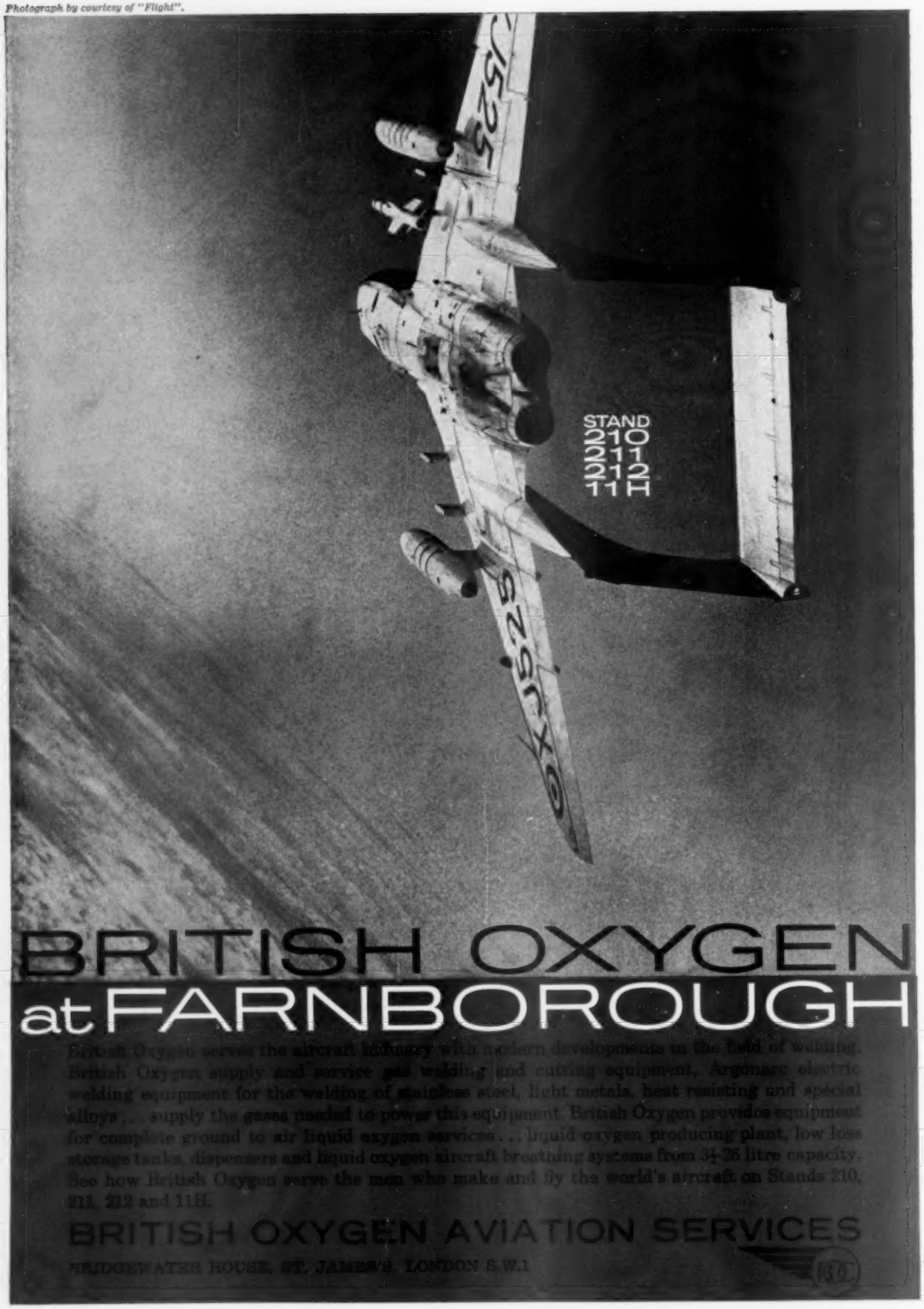
Photograph by courtesy of "Flight".



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British Oxygen serves the aircraft industry with modern developments in the field of welding. British Oxygen supply and service gas welding and cutting equipment. Argonarc electric welding equipment for the welding of stainless steel, light metals, heat resisting and special alloys . . . supply the gases needed to power this equipment. British Oxygen provides equipment for complete ground to air liquid oxygen services . . . liquid oxygen producing plant, low loss storage tanks, dispensers and liquid oxygen aircraft breathing systems from 3½-25 litre capacity. See how British Oxygen serve the men who make and fly the world's aircraft on Stands 210, 211, 212 and 11H.

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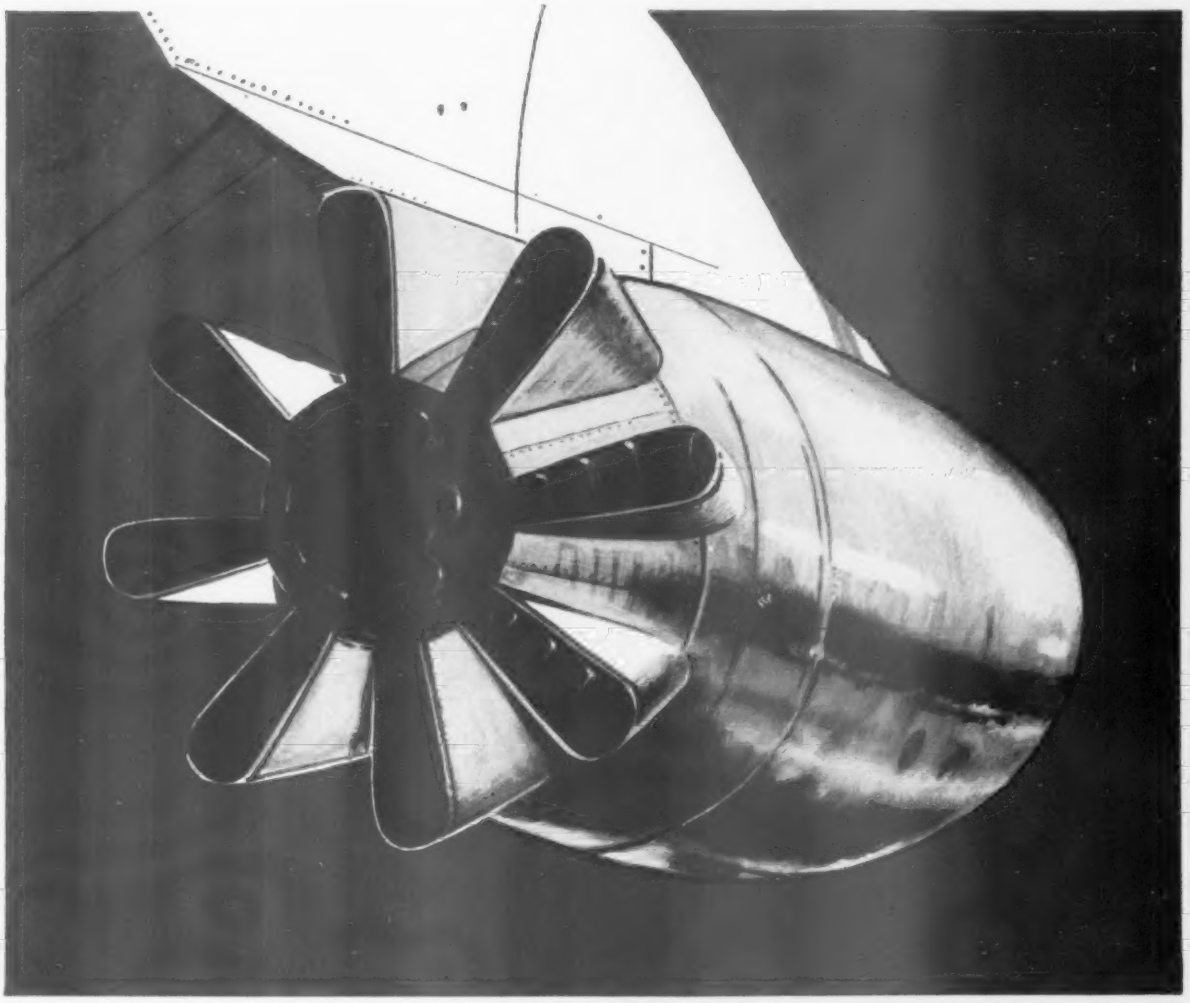

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NIMONIC*

HEAT-RESISTING ALLOYS

Time flies . . . With it comes progress in turbo-jet design . . . Progress in power output, operational efficiency and reliability . . . Progress dependent on heat-resisting alloys in the world-famous NIMONIC* Series produced by Henry Wiggin & Company Ltd. and employed for high-temperature parts in every British aero gas-turbine.

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1944 *Rotor and stator blading of Nimonic Alloy were used for the Rolls-Royce 'Welland' turbines of Britain's first operational jet, the Gloster Meteor Mk. 1.* **1961** *Nimonic alloys serve for high-temperature components in the Rolls-Royce 'Conway' by-pass power unit for many Boeing 707's of the world's leading airlines.*

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Hydrant Refuelling the World Over

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Rapid aircraft refuelling from hydrants at modern airfields is accomplished with the use of Avery-Hardoll refuelling equipment.

The Hydrant Pit, embedded in the apron, is connected to an underground fuel pipeline. For refuelling, the pit cover is removed. The Quick Release Valve is connected by an Avery-Hardoll coupling and a hose to a mobile dispenser, which uses an Avery-Hardoll Bulkmeter. A second hose conveys the fuel from the dispenser to the aircraft by means of another Avery-Hardoll coupling.

The advantages in speed of refuelling and the elimination of spillage are two reasons why Avery-Hardoll Equipment has been so widely standardised.

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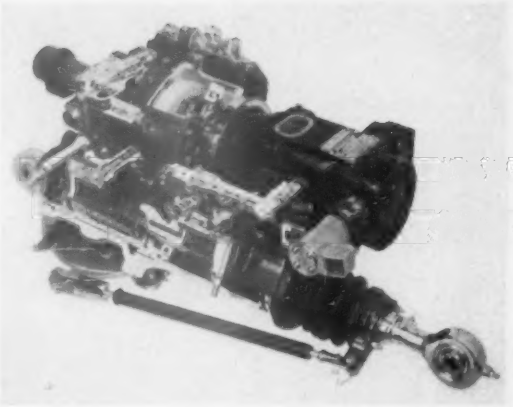
Guide to the Static Displays . . . .

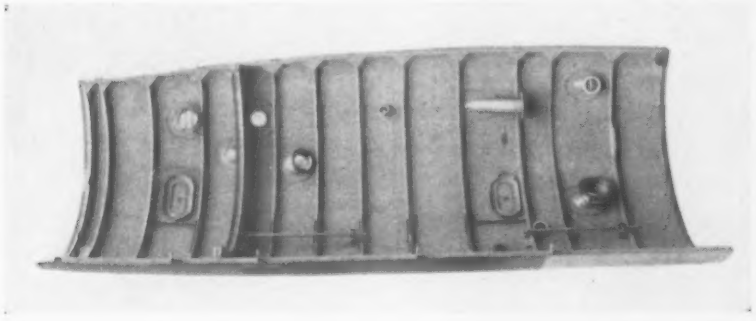
E.M.O. Instrumentation, Ltd. (110). Products on display comprise precision bearings covering the field of " very high speed to very low torque "; bearing torque-testing instruments; and a Barden Smoothrater designed to predict the performance qualities of oil-lubricated ball bearings up to 1 in. outside dia.

English Electric Aviation, Ltd. (294) and the **English Electric Co., Ltd.** (295). On display is a British-built Sundstrand constant-speed drive unit which has completed 1,600 hours operation in B.O.A.C. Boeing 707 G-APFP; a new single-channel 30kVA constant frequency electrical system employing components similar to those already proven on the 707; and a 55kVA " wild " frequency generating system, similar to those designed for the Type Z Rotodyne. The insignia of some of the 50 airlines which carry English Electric aircraft equipment are also on the stand.

A VC10 hydraulically operated aileron powered flying control unit designed by Bolton Paul Aircraft for the acceptance of mechanical and electrical signals (right).



A stretched-formed panel for the cowling of the Rolls-Royce Conway produced from 6 ft. wide 21 s.w.g. British Aluminium 2L73 precipitation treated aluminium sheet.



English Steel Corporation, Ltd. (127). The background of this stand features the company's current £26-million development scheme at Tinsley Park, Sheffield. Exhibits include machined and drop-forged airframe, engine and propeller components; special aircraft steels; engineers' cutting tools, and a selection of permanent magnets.

E.N.V. Engineering Co., Ltd. (272). Specialists in gears, this company is displaying examples of precision spiral bevel and spur gears with particular emphasis on spiral bevel gears with profile-ground teeth for helicopter main and tail rotor drives.

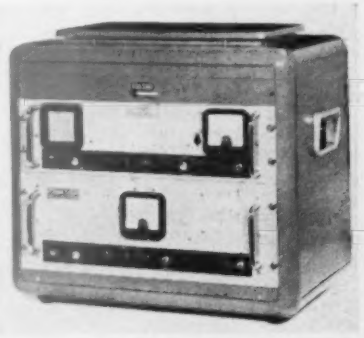
Esso Petroleum Co., Ltd. (66). Numerous publications on the company's range of aviation fuels and lubricants.

Exactor, Ltd. (205). Exhibits cover Wilkerson self-drain air cleaners for use with compressed air lines; a range of self-sealing couplings and pressure balanced couplings; and a new double-acting actuator for remote control applications.

Export Packing Service, Ltd. (73 and O.D.S.P). Specialists in the packing of aircraft components, radio and electronic equipment.

Fairey Engineering, Ltd. (C, 11 and M.P.), **The Fairey Aviation Co. of Canada, Ltd.** (10) and **Fairey Aviation Co. of Australia, Pty., Ltd.** (9). Features on these stands include trials aids for the Jindivik target aircraft; hydraulic flying controls for the Scimitar; an elevator unit for the Hindustan HF-24; a Belvedere power-control unit; Fairey microfilters; missile and target lenses and cameras; and a power follow-up unit for the Hunting 126. A Jindivik Mk. 2B and a new airportable launching vehicle for the Malkara anti-tank weapon are in the missile park.

Ferranti, Ltd. (184 and 185). One of the main features is the new Ferranti Type 100 intermediate-size stable platform for aircraft navigation systems. Other exhibits include Airpass and I.S.I.S. radar and fire-control systems; aircraft gyroscopic instruments and transistorized power packs; gyroscopes and accelerometers; and a variety of electronic components.



Cossor Series 109 transmitter and receiver. Both units can be mounted together, as seen in this illustration (right), or separately as independent equipment if required.

Production version of the new Decca Radar transistorized display drive equipment. This is capable of driving approximately 20 radar display viewing units and has facilities for generating multiple interscan and alpha-numeric data (left).

Fibreglass, Ltd. (30). Products include Fibreglass insulation and reinforced plastics for aircraft.

Field Aircraft Services, Ltd. (233). Activities cover the sale, repair, modification and overhaul of aircraft, instruments, accessories and engines; aircraft conversion and maintenance and servicing; airscrew overhauls and repairs; radio testing and overhaul.

Fireproof Tanks, Ltd. (97). New products cover Hy-Clad rubber/metal/rubber laminate; Polyurethane and other compounds for all moulded components subjected to high temperatures; Viton temperature-resistant sheet and fabrications; and Hycaflex containers.

Firestone Tyre and Rubber Co., Ltd. (12). On display are several examples from the wide range of Firestone aircraft tyres made at the company's English factory at Brentford. In particular, there are examples of high-speed tyres for jet aircraft, which have been specially developed to stand up to the heavy strains of 225-m.p.h. landings.

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Guide to the Static Displays . . . .

T. F. Firth and Sons, Ltd. (29). Makers of upholstery fabrics and carpeting for aircraft cabins.

Thos. Firth and John Brown, Ltd. (234), and **Firth-Derihon Stampings, Ltd.** (235). A joint display with the emphasis on vacuum-melted steels and a centre panel featuring a sectional illustration of the Firth Brown vacuum-melting unit. Exhibits include rolled rings, drop forgings, turbine discs and gas turbine blades.

Firth-Vickers Stainless Steels, Ltd. (17). Manufacturers of a wide range of stainless steels for the aircraft industry and centri-die cast and precision-cast components for gas turbines.

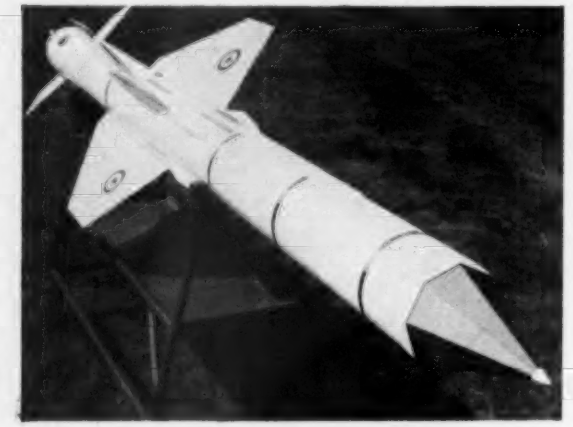
W. T. Flather, Ltd. (128). Specialized A.I.D.-tested aircraft steels; carbon and alloy steels and forgings.

Flexible Ducting, Ltd. (281). Exhibiting for the first time at the show, this company is displaying Flexflyte air-conditioning hose together with service hoses, such as fuel hose and silicon jet starter hoses. In addition, there is a representative range of current types of flexible pipes.

Fothergill and Harvey, Ltd. (256). The diversity of the company's products is emphasized on this stand. They include pre-impregnated Tyglas fabrics; Tygaflor PTFE/glass products; Tyglass 3D woven shapes; and Lantor/Tygaweb non-woven natural and synthetic fabrics.

Samuel Fox and Co., Ltd. (122), and **Steel, Peach and Tozer, Ltd.** (123). Vacuum melting and casting of steel and the use of an electronic computer to control a billet cut-up line are some of recent technical advances featured in this joint display. One of the larger exhibits is a 45-in.-dia. coil of 40-in. wide stainless steel sheet, weighing over 4 tons. Examples of fabrication in Fortiweld quality sheet include a fireproof bulkhead for a Rolls-Royce Tyne.

P. Frankenstein and Sons (Manchester), Ltd. (161), and **Beaufort (Air-Sea) Equipment, Ltd.** (162). A double stand displaying a wide range of life-saving, survival and protective equipment for civil and military use. The civil exhibit is highlighted by a miniature display of liferafts and other inflatable equipment. The centre piece of the military equipment is the first exhibition of a full-pressure suit designed for very high altitude.



Currently under development, the D.H. Red Top, like Firestreak, is an infra-red homing AAM. An E.E. Canberra has been specially modified to conduct field trials with the missile's guidance system.

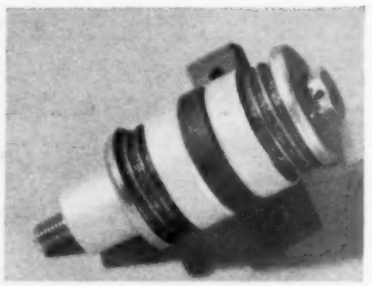
Flight Equipment and Engineering, Ltd. (259). Products cover aircraft passenger and crew seats and accessories.

Flight Refuelling, Ltd. (245 and O.D.S.V and 4). Exhibits cover a wide range of refuelling and fuel systems equipment, together with a Meteor U.16 pilotless target aircraft.

Formica, Ltd. (257). Industrial laminates, including copper-clad material for printed circuits, and fabric, glass and paper-based laminates are on display. Formica printing and engraving materials are also shown.

The Gear Grinding Co., Ltd. (218). Manufacturers of aircraft gears, both spur and helical, and similar components; gear and spline grinding machines; and involute and lead-measuring machines used in the finish, grinding and inspection of gears.

General Electric Co., Ltd. (33, 34 and M.P.). Among the exhibits on show are a recently developed digital data transmission system for application to Air Traffic Control; a new system for controlled dimming of aircraft cockpit and instrument lighting using neon discharge lamps; a visual glide-path indicator system and a deck-landing projector sight; and aircraft galley equipment, including a new design food container for B.E.A.



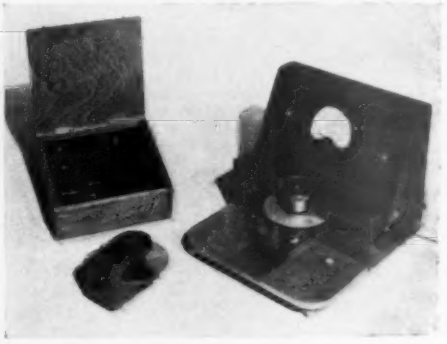
The Delaney Gallay Vibrashock-Isolation all-metal anti-vibration mounting. The resilient element of knitted stainless wire can be seen.

General Precision Systems, Ltd. (143). As the company's recently introduced equipments are too large for display, the stand is being used as a centre for meeting friends in the aviation industry.

Girdlestone Pumps, Ltd. (138). Exhibits comprise aircraft aerials; moulded electronic components; instrument leads, plugs and sockets; co-axial and multi-core connectors; plastic non-drift nuts for potentiometers; and pumping equipment.

Girling, Ltd. (124). Latest developments in control surface and flutter dampers; detail items including linear telescopic dampers and a helicopter damper. Control column dampers and viscous shearing dampers are also displayed.

Gloster Aircraft Co., Ltd. (O.D.S.S and 8). Airfield equipment on display comprises a fire appliance mounted on a standard Land Rover 88 in. chassis and a Miles Verro Minor suction sweeper suitable for cleaning hangar floor-space, taxi-ways and airport aprons.



E.M.O. Instrumentation bearing torque measuring equipment.

Sir George Godfrey and Partners, Ltd. (31), and **Godfrey Engineering Co., Ltd.** (32). The main exhibit is a Godfrey/S.R.M. gearbox compressor employed in the VC10 pressurization and air conditioning system. Four of these engine-mounted units are used in the aircraft, together with two Godfrey electro-pneumatic mass-flow controllers for monitoring their slide valves.

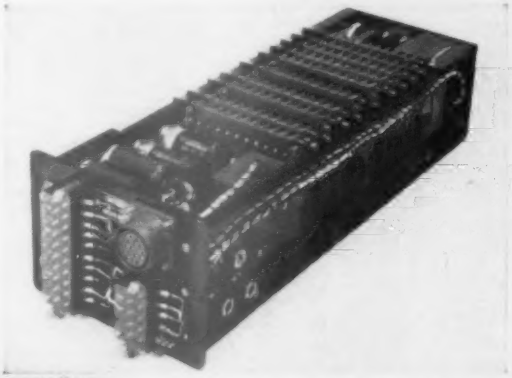
Goodmans Industries, Ltd. (142). Manufacturers of vibration generators and electronic driving equipment for mechanical testing of aircraft structures and components.

D.H. Firestreak AAMs are the standard armament for the Royal Navy's Sea Vixens and the R.A.F.'s Lightnings and Javelins.

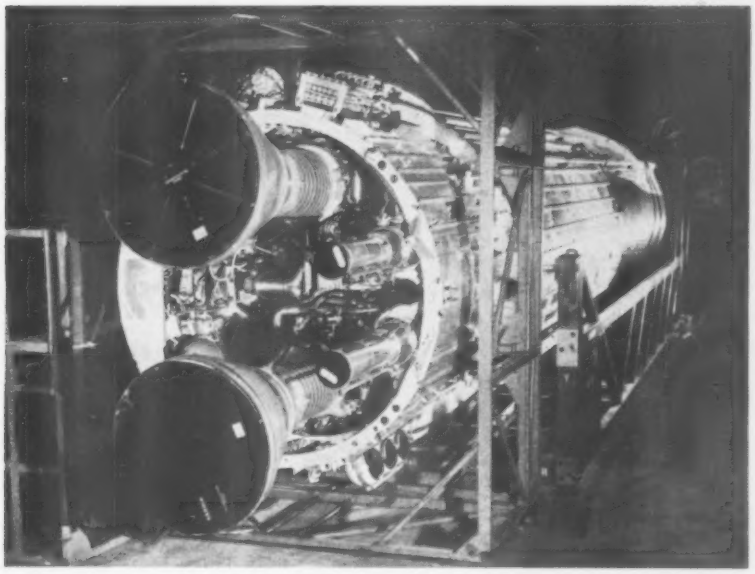
The Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd. (69). A comprehensive range of tyre, wheel, brake and anti-skid equipment is on display. Of special interest is the Goodyear thermal tyre, specified for the Bristol T.188 all-steel research aircraft. Also on display is the Blue Dot sidewall inflation principle which eliminates conventional valves and cores.

G.Q. Parachute Co., Ltd. (64). Working model demonstration of man-stabilization systems and barometric release units, together with a photographic display of the company's many types of parachute.

Graseby Instruments, Ltd. (179). Range o gyroscopic test equipment including a servoed gimbal universal tester with automatic photo-electric read-out; rate-gyro calibration table; gyro temperature controller; centrifuge; together with guided missile and control equipment comprising accelerometers; accelerometer recorders; rate gyros; yaw meters; and pressure transducers.



An AC generation system control and protection unit manufactured by the English Electric Aircraft Equipment Division at Bradford.



The D.H. Blue Streak, which may become the first stage of a European heavy satellite launcher, seen in its handling frame.

The Hairlok Co., Ltd. (82). Manufacturers of Hairlok rubberized hair; Texfoam latex foam; and Texfoam block foam.

John Hall and Sons (Bristol and London), Ltd. (15). Manufacturers of aircraft finishes, including aero-engine paints, dopes, varnishes and lacquers.

Handley Page, Ltd. (B). Models and displays feature the Victor B.2, the Herald, the H.P. 115 research aircraft and research for laminar-flow and supersonic airliners.

Harley Aircraft Landing Lamps (96). Producers of various types of lighting equipment including landing and taxiing lamps and mobile floodlighting.

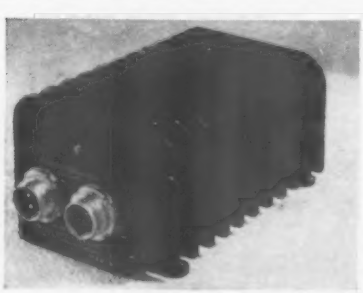
Hawker Siddeley Aviation, Ltd. (L, 148–153 and O.D.S. T, S, P1 and 8, and M.P.). A model of an Avro Vulcan B.2 fitted with Douglas Skybolt ASMs is shown for the first time, together with special displays featuring the Trident, the D.H. Jet Dragon, the Armstrong Whitworth Argosy and the Avro 748 feeder-liner. The Comet, Hunter Trainer, Gnat Trainer, Caribou, Otter and Beaver are also featured. In the aircraft engine section there are the Blackburn Cumulus turbo-compressor and Astazou gas turbine; the D.H. Gnome and Gyron Junior. On separate stands there are joint displays of electronic and ancillary products by Blackburn Electronics, de Havilland and Armstrong Whitworth Equipment. Blue Steel and Seaslug are in the missile park, and the A.W.A. Rolamat system and the Blackburn Air Delivery system are featured outside.

Graviner Manufacturing Co., Ltd. (219). New developments on display include Triple FD Firewire and B.C.F. automatic and airborne hand fire extinguishers. A smoke detector, a smoke viewer and a sealed H.S.R.S. fire detector are also featured.

Grundy and Partners, Ltd. (258). Exhibits of the company's Electronics Division comprise a transistor test meter; a transistorized ignition spark timing equipment; a 0–50V stabilized power unit; and a thermocouple amplifier.

Guest, Keen and Nettlefolds (Midlands), Ltd. (147). The usual range of high-quality fasteners are shown by the Screw Division and lightweight nuts and special bolts by the associate company, T. J. Brooks (Leicester), Ltd.

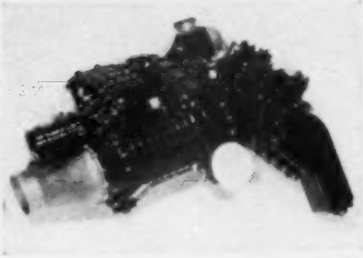
J. J. Habershon and Sons, Ltd. (191). Strip and bar for the aircraft industry in stainless, alloy carbon and mild steel.



Left, Ekco Type E.210 transistor inverter, which has received unlimited Air Registration Board approval.

Right, Army counterpart of the Bloodhound is the English Electric Thunderbird SAM.

Guide to the Static Displays . . . .



H. M. Hobson, Ltd. (165). Display includes feel simulator units, controls and jacks; various flap controls; powered flying controls; fuel flow proportioners; a constant-speed alternator drive; various fuel engine controls; and electro-hydraulic equipment.

H.M.L. Engineering, Ltd. (O.D.S. Y and 1). Almost entirely devoted to the needs of the smaller airline, this display includes a modified version of the company's Mk. 5 mobile test rig; an 8-g.p.m. hydraulic component test bench; a lightweight thermostat checking rig; and the new Mini-Minirig helicopter hydraulic test rig.

A Godfrey/SRM gearbox compressor Type GB80/210 Mk. 1. Four gearbox compressors of this type provide the charged air for the pressurization and air conditioning system in the Vickers VC10.

To replace the American-built Corporals in use with the Army, the Blue Water tactical SSM (right) is being developed by English Electric.

Heenan and Froude, Ltd. (132). This company produces piston, turbo-prop and turbojet test plant and wind-tunnel test plant. Also torque reaction stands and torque- and thrust-measuring gear.

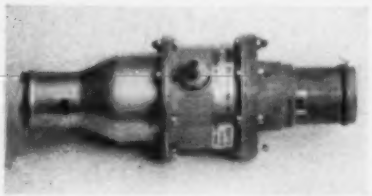
Hellerman, Ltd. (172). Products include plugs and sockets; cable-sealing devices; Dymo-Mite hand embossing tool; cable binding and marking sleeves; wiring tools; wiring terminal blocks; plastic mouldings and extrusions.

Hendrey Relays, Ltd. (236). Prominent among the items on show is a new hermetically sealed, high-performance Hendrey relay Type D.4750, which has four change-over wiping contacts rated at 15 amp, 30 DC or 200V 400 cycles. Flame-proofness testing equipment is also on display.

Hepworth and Grandage (Yeadon), Ltd. (180). This company specializes in the production of gas turbine blades, compressor blades, and turbo-supercharger blades for aircraft and industrial units. A wide range of blades is displayed on the stand.

High Duty Alloys, Ltd. (208). Three new processes are featured on this stand. The first of these is cold forging, whereby it is possible to produce cylindrical components with a wall thickness as low as 0.006 in. and on the more robust types incorporate flanges and splines; the second new process is for the production of high quality pressure die castings; and the third is Comocast die casting.

High Pressure Components, Ltd. (56). Manufacturers of Gyp range of pipe-to-pipe and reusable hose couplings; various types of charging and relief valves.

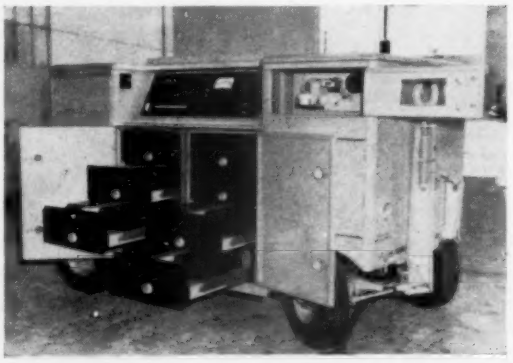


A Hymatic Engineering dual inward/outward vent valve for the control of air pressure in fuel tanks.

Honeywell Controls, Ltd. (292). On show for the first time is the Honeywell automatic systems analyser for diagnosing faults in complex airborne electronic systems. The company's latest micro-switches are also on display.

Hordern-Richmond, Ltd. (102). Aircraft tooling processes and laminated wood blades are the main features of this stand. Some new possibilities of the Templet industrial process for blanking and piercing operations are shown, together with an inexpensive lightweight set of laminated birch and mahogany ply autogyro blades. Standard products also displayed.

Houchin, Ltd. (O.D.S. A and 17). Two new designs of mobile aircraft ground power units without brushes—the RECTI-HY-CY and the RECTI-CY are exhibited. The first provides outputs of 60 kVA, 208V, 3-phase, 400 c.p.s., 112V DC and 28V DC; and the second unit has an output of 28V DC.



Above, Malkara, the Australian designed anti-tank weapon for which Fairey Engineering are the U.K. co-ordinating design authority and also, with the exception of the U.S., World sales agents.

The Honeywell automatic systems analyser for the automatic maintenance of complex aircraft systems. Built on the modular basis, this equipment has been chosen by the R.A.F.

The Hughes-Johnson Stampings, Ltd. (70). Manufacturers of drop forgings of the more intricate type in carbon, nickel, nickel chrome and all alloy steels, non-ferrous high nickel chrome alloys, copper, aluminium alloys and titanium alloys.

The Hymatic Engineering Co., Ltd. (273). On display are systems for fuel pressurization, anti-*g*, radome, air ventilated suits, and those for specialized missile air-supply systems. A wide selection of Hymatic equipment for aircraft and missile applications is also exhibited.

Alfred Imhof, Ltd. (182). New on this company's stand is the miniature Imlok construction system as well as the standard one shown last year. Also displayed is a range of cases, racks, consoles and accessories for housing all types of instruments and equipment in connection with missile control installations, airport installations and ground test equipment.

Imperial Chemical Industries, Ltd. (Metals Division) (121). The feature of this stand is the growing use of titanium for airframe and powerplant components. In addition to a representative group of titanium fabrications, including a Sea Vixen wing rib using I.C.I. titanium 317, there is a technical exhibit showing the method and result of various tests undertaken by the aircraft industry on I.C.I. titanium alloys. Samples of wrought beryllium and niobium will be among the "new" metals shown.

Imperial Chemical Industries, Ltd. (Paints Division) (120). Details of the company's comprehensive range of metal pre-treatment and painting systems to meet current specifications are available on this stand. Many of these systems are at present in use on both civil and military aircraft, including the Comet, Vanguard, Argosy, Herald, and Hawker P.1127, and have also been specified for use on the Vickers VC10 and D.H. Trident.

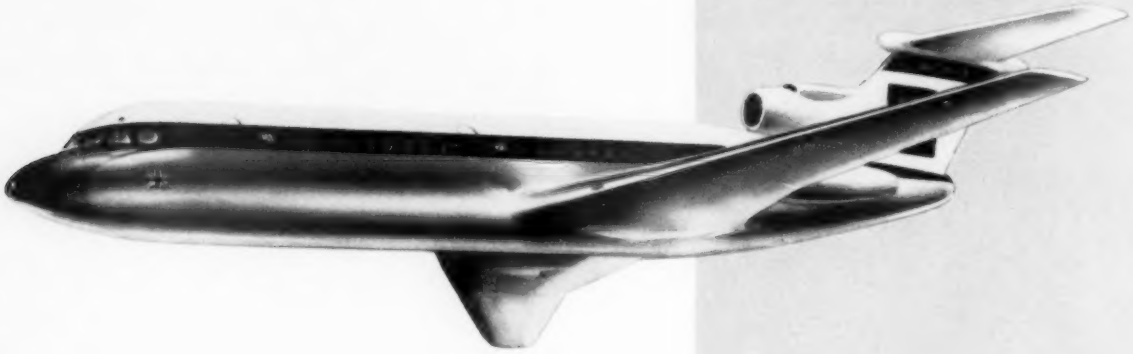
Imperial Chemical Industries, Ltd. (Plastics Division) (135). Products include Perspex acrylic sheet; Diakon acrylic moulding and extrusion material; alkathene; Darvic rigid p.v.c. sheet; Flovic; p.v.c. copolymer foil; and Fluon.

Integral, Ltd. (164). Exhibits on show for the first time comprise constant-speed pumps and motor pump units. Other items include hydraulic pumps; a hydraulic pump/electric motor power pack; a fluid flow divider; a constant-flow valve; constant pressure pumps; a tachometer unit; a transistorized rate-of-flow meter; and a four-channel mass flowmeter.

KEEPING PACE WITH THE PACEMAKERS

FARNBOROUGH 1961

DOWTY side by side with ci



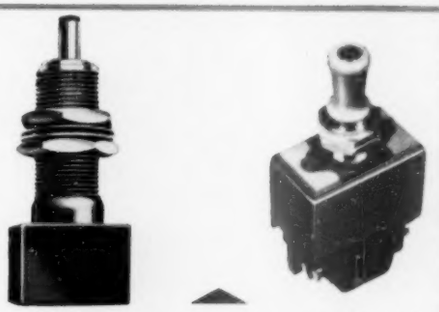
The de Havilland Trident uses Dowty Rotol ram air turbines and Dowty electrical components.

The Avro 748 is fitted with Dowty Rotol undercarriages, propellers, gearboxes and synchronizing equipment.

PROPELLERS · UNDERCARRIAGES · FUEL SYSTEMS

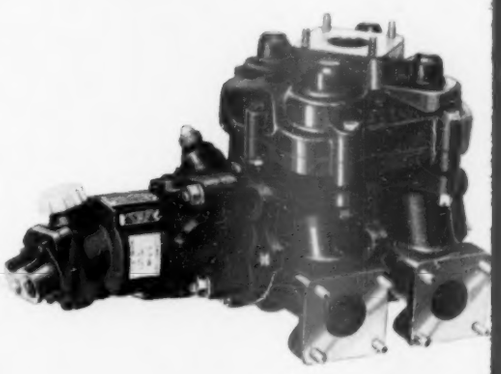
civil and military need

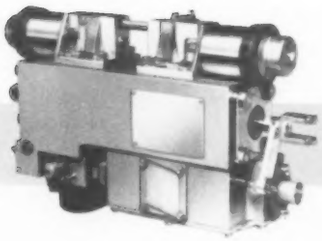
The Vickers VC10 uses Dowty Rotol ram air turbines.



New units from Dowty Electrics range—the hermetically sealed microswitch and a toggle switch. Most aircraft carry Dowty electrical components.

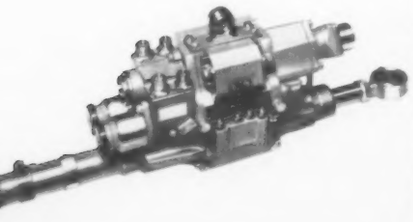
Lightnings of No. 74 Squadron, R.A.F., rely on Dowty Rotol undercarriages and nosewheel steering, air turbines and hydraulic systems.





Dowty Rotol servo flying controls in use on British and overseas-built aircraft.

Dowty Rotol fuel flow proportioners have completed one million flying hours.



NATO'S strike fighter, the Fiat G91, flies with Dowty Rotol fuel flow proportioners.

FUEL FLOW PROPORTIONERS · FLYING CONTROLS

ELECTRICS · HYD

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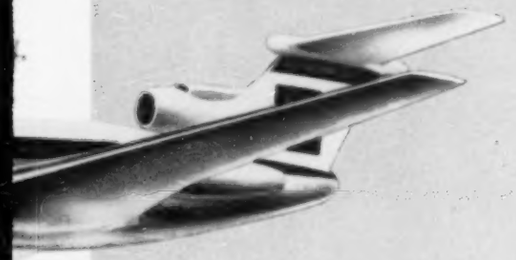

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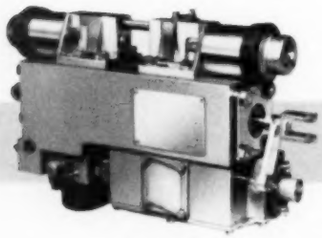

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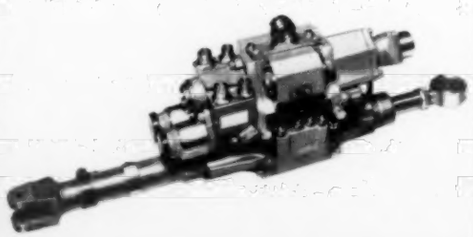
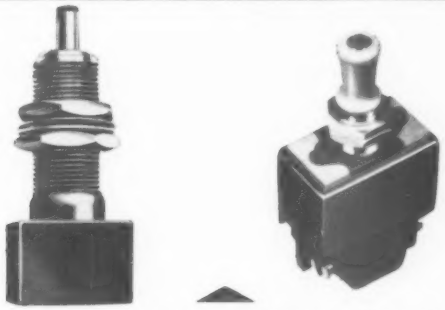


GES · FUEL SYSTEMS

FUEL FLOW PROPORTIONERS · FLYING CONTROLS

military needs



New units from Dowty Electrics range—the hermetically sealed microswitch and a toggle switch. Most aircraft carry Dowty electrical components.

Dowty Rotol fuel flow proportioners have completed one million flying hours.

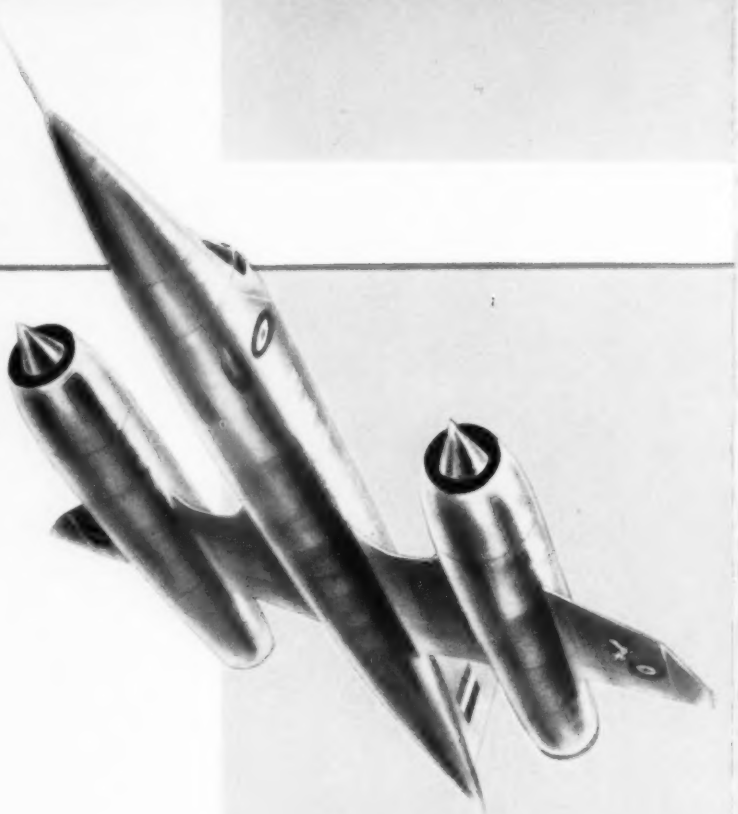
The Avro Vulcan, spearhead of Britain's V-bomber force, is fitted with Dowty Rotol undercarriages and hydraulic equipment.

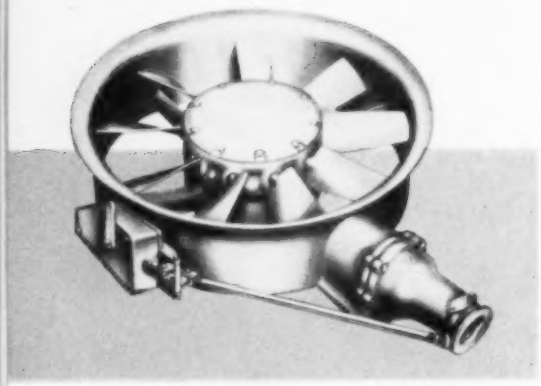
NATO'S strike fighter, the Fiat G91, flies with Dowty Rotol fuel flow proportioners.

ELECTRICS · HYDRAULIC PUMPS AND JACKS

development

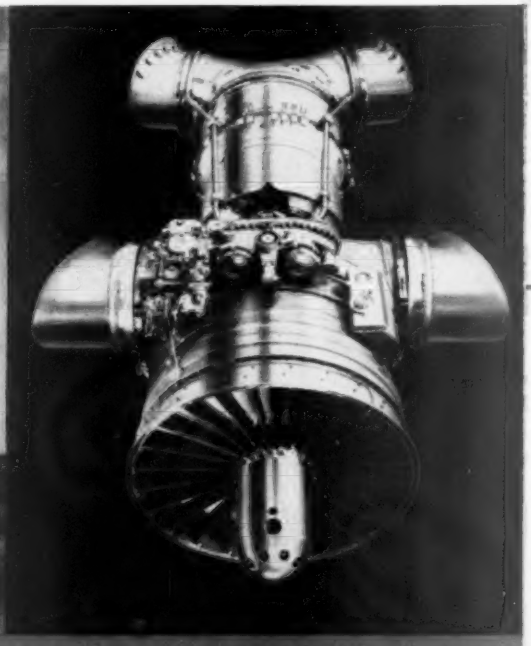
The Bristol B188, for supersonic research, uses Dowty fuel control systems, flying controls, undercarriage and high temperature hydraulics.





The Dowty Rotol Control Lift Fan for pitch and roll control on VTOL/STOL aircraft.

Britain's latest V.T.O.L. aircraft, the Hawker P1127, is fitted with Dowty Rotol undercarriages, steerable nosewheel unit, and hydraulic components. A Dowty fuel control system is part of the revolutionary Bristol BS53 engine which powers the aircraft.



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CONTROL LIFT FANS · AIR TURBINES · SERVO VALVES

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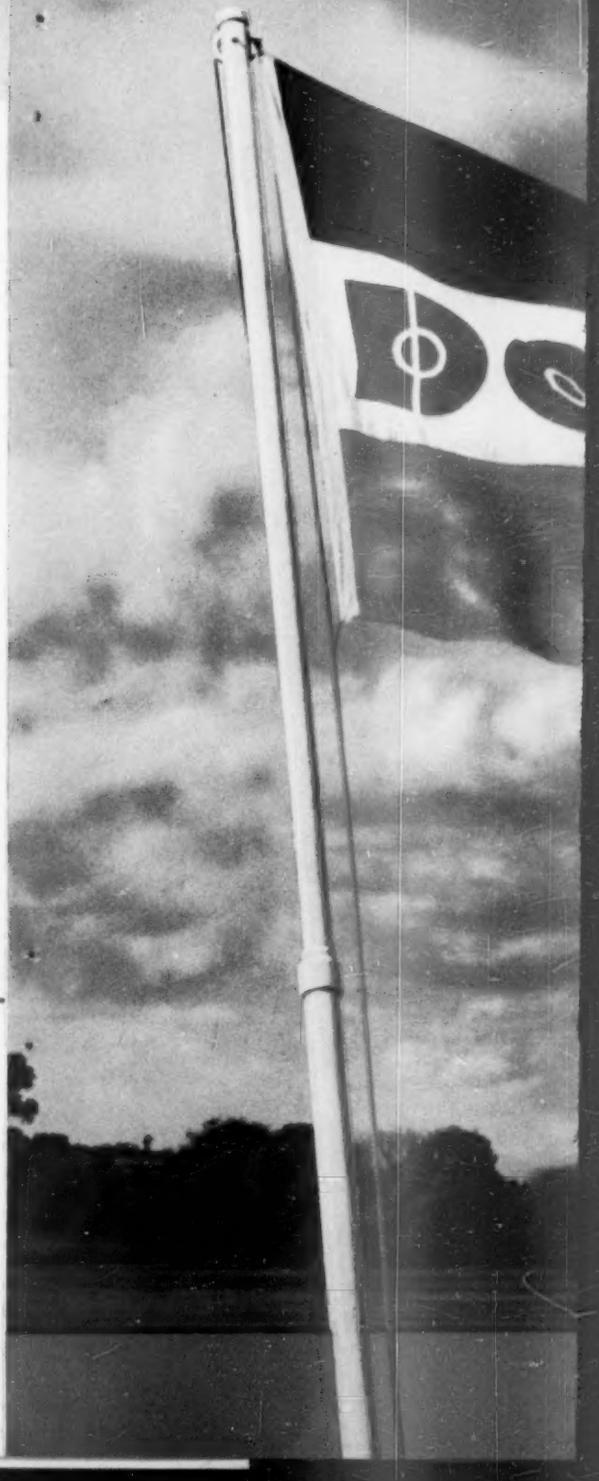
..and in the cargo field

The Armstrong Whitworth Argosy relies on Dowty undercarriages, propellers, gearboxes, hydraulics and electrics. (Main undercarriage on left.)

SEALS AND MOULDINGS



A bulletin from Europe's largest manufacturer of aircraft equipment

OWTY GROUP LIMITED · CHELTENHAM · ENGLAND

DOWTY ROTOL LIMITED : CHELTENHAM ROAD : GLOUCESTER
Telephone: Gloucester 24431

DOWTY FUEL SYSTEMS LIMITED : ARLE COURT : CHELTENHAM
Telephone: Cheltenham 53471

DOWTY ELECTRICS LIMITED : TEWKESBURY : GLOS.
Telephone: Tewkesbury 2383

DOWTY SEALS LIMITED : ASHCHURCH : GLOS.
Telephone: Tewkesbury 2271

BOULTON PAUL AIRCRAFT LIMITED : WOLVERHAMPTON
Telephone: Fordhouse 3191

DOWTY EQUIPMENT OF CANADA LIMITED : AJAX : ONTARIO
Telephone: Whitehall 23100

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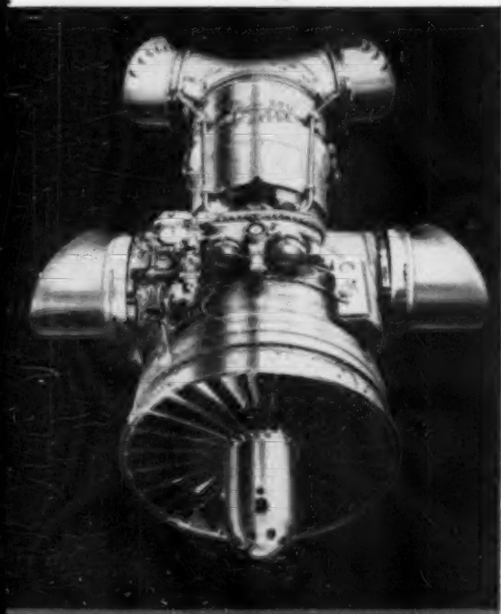

NES · SERVO VALVES

SEALS AND MOULDINGS

Dowty Seals and Mouldings are produced in a wide range of compounds to suit all requirements. They are approved for use with Skydrol, D.P.47, fuel, hydraulic and mineral oils.

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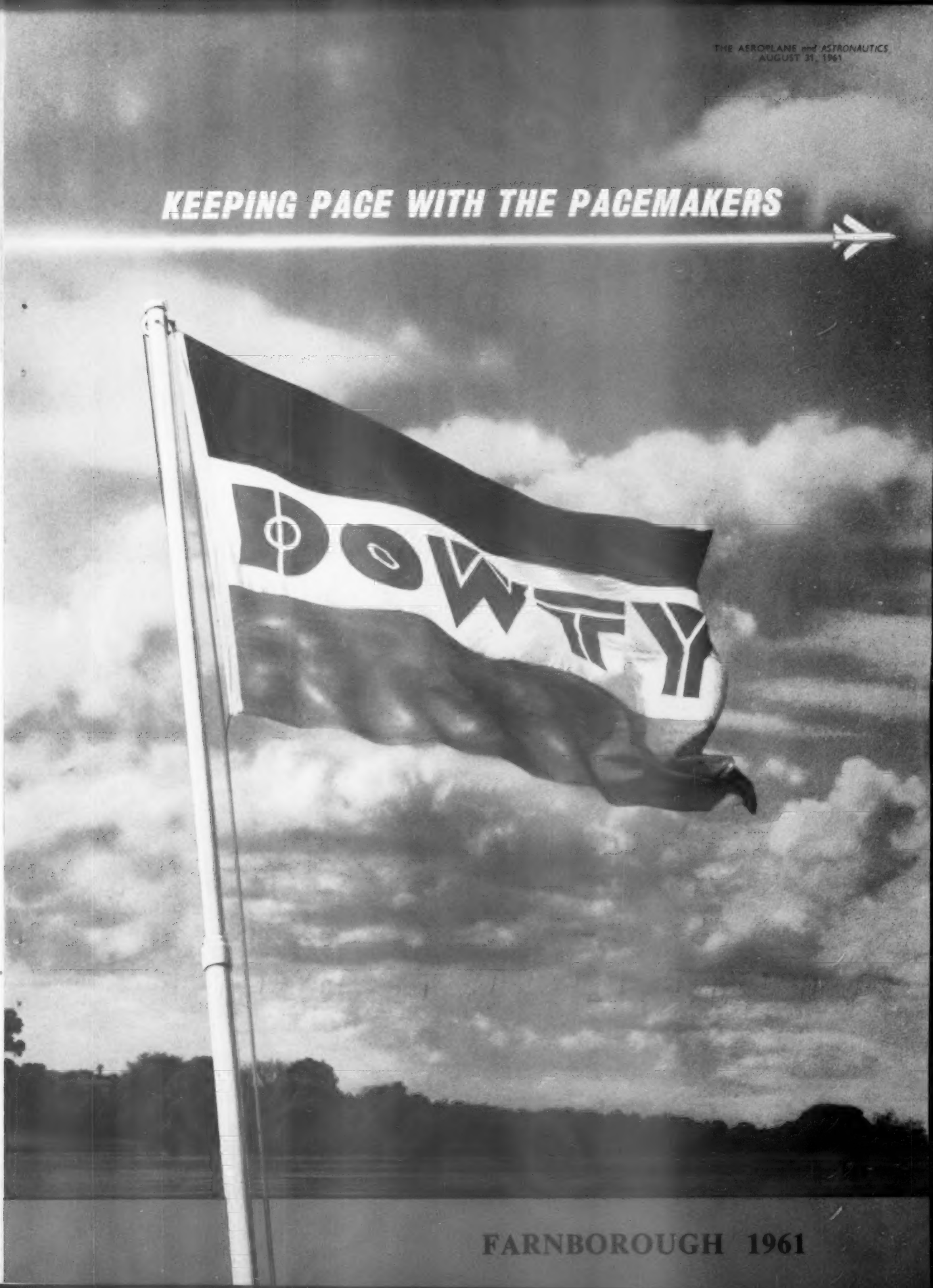
KEEPING PACE WITH THE PACEMAKERS



FARNBOROUGH 1961

..and in the cargo field

The Armstrong Whitworth Argosy relies on Dowty undercarriages, propellers, gearboxes, hydraulics and electrics. (Main undercarriage on left.)

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Guide to the Static Displays . . . .

International Nickel Co. (Mond), Ltd. (25). Refiners of nickel.

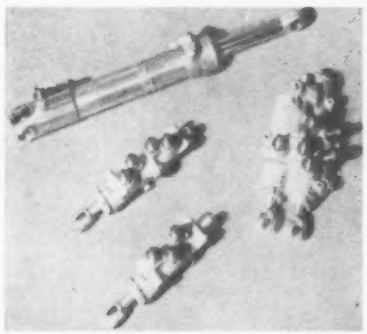
Irving Air Chute of Great Britain, Ltd. (225). Exhibits comprise a professional parachute assembly Type PB1; a landing brake parachute assembly designed specially for the Bristol 188; and a new landing brake parachute for the English Electric Lightning. This parachute is designed to facilitate the repair of damage which may occur in service by contact with the runway or as a result of heat from the jet efflux.

Jessop-Saville, Ltd. (38). This stand features a demonstration of vacuum melting techniques which have been applied to the production of a wide range of Jessop-Saville gas turbine alloys, high-speed steels and ultra high-tensile steels.

Kelvin and Hughes (Aviation), Ltd. (3). See Smiths Aviation Division.

Kenilworth Manufacturing Co., Ltd. (288). This company has extended its D.B. Toolform plastic tooling service range and new grades are shown including those for vacuum forming. Various types of fitting and jointing compounds are also displayed.

Flame proofness testing equipment manufactured by Hendrey Relays. It consists of a cylindrical explosion chamber and control console.

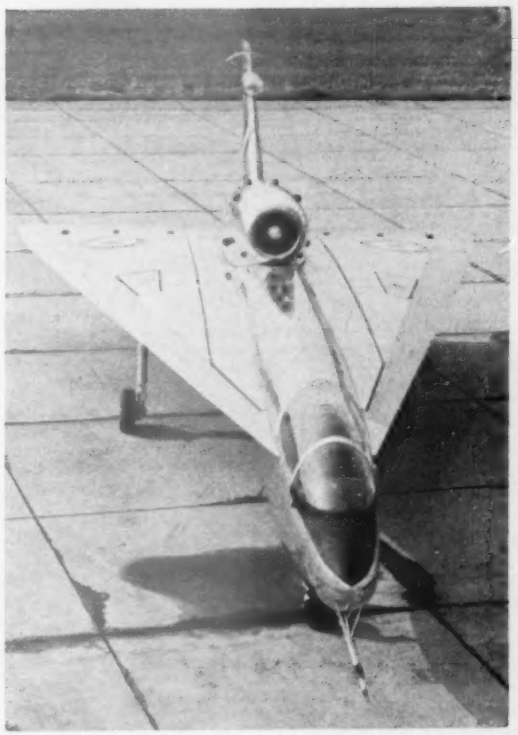


Lockheed nose undercarriage door jack, power on/off valve, emergency undercarriage valve, and undercarriage selector and dump valve for the D.H. Trident.

Ketay, Ltd. (77). A representative selection of synchros, resolvers, precision integrating tachometer-generators, servo motors, and servo-magnetic amplifiers for instrumentation and light power applications are on display. Of particular interest are a new jet engine thrust indicator; a servo controlled aerial turning unit; and a new range of torque synchros.

The Walter Kidde Co., Ltd. (171). Emergency oxygen breathing systems on show include portable sets; flight crew emergency systems and portable smoke sets with full face masks. Also shown are lightweight fire extinguishers; automatic liferafts; the Rotawin inflatable radar reflector; and high pressure inflatable structures for airport u32

Low-speed handling characteristics of high-speed aircraft of similar planform are to be explored by Handley Page H.P. 115.



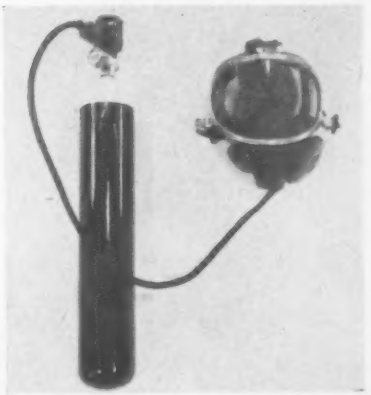
King Aircraft Corporation (65). On show for the first time in this country is the Thermoid-Quaker jet starter hose which is in extensive use in the United States. King fasteners, pipe clamps, universal band clamps, Conoseal couplings, flexible metallic hose and cargo handling aids are also featured on the stand.

K.L.G. Sparking Plugs, Ltd. (1). See Smiths Aviation Division.

Lancefield Aircraft Components, Ltd. (176). Exhibits include a prototype second-class double seat; first-class passenger chairs; Comet pilot and navigator seats; Dove and Heron passengers' and crew seating; aircraft protective covers; Lancedown and Lancefoam lightweight upholstery; and all types of radar waveguides.

Latex Upholstery, Ltd. (278). Products include aircraft passenger-seat upholstery; lightweight upholstery; cushioning; escape chutes; Kargo Pak cabin freight containers; and furnishing materials.

Lep Transport, Ltd. (109). Specialists in the packing and shipping of aircraft and components, including tropical packing and preservation, salvage and transportation of damaged aircraft.



Portable oxygen smoke equipment designed and manufactured by Walter Kidde. The total weight of the apparatus, including mask, is approximately 11 lb.

Lockheed Precision Products, Ltd. (54). See Automotive Products, Ltd.

Lodge Plugs, Ltd. (16). Aviation products exhibited by this company are jet engine igniters, thermocouples, sparking plugs and equipment for testing and servicing the last named. Also the Sintox range of ceramics.

Joseph Lucas (Batteries), Ltd. (105). Products on display comprise oxide/zinc batteries for missiles, etc.; a range of 24V 16 ampere-hour lightweight fully aerobatic aircraft batteries; a transport aircraft 25-ampere-hour capacity battery; and military aircraft batteries. Two methods of battery ventilation are also demonstrated—from the lid for batteries used in aircraft with pressurized systems and with side tubes for forced draught extraction.

Lucas Gas Turbine Equipment, Ltd. (103 and O.D.S. 15 and B). The main display is centred around units, sectioned and complete, covering fuel system and combustion equipment available for a range of typical aircraft applications. Other exhibits include hydraulic and electrically driven boost pumps; hydraulic pumps and motors; and quick release couplings. A sprayer calibration rig, a paraffin wash unit, and samples of large sheet metal fabrications are shown outside.

Lucas-Rotax, Ltd. (104 and O.D.S. 15 and B) and **Lucas Rotax (Australia) Pty., Ltd.** (125). See Lucas Gas Turbine equipment, Ltd., and Rotax, Ltd.

Magnesium Elektron, Ltd. (166). The use of magnesium in helicopters is the subject of this company's exhibits, with particular reference to the Westland Wessex and Whirlwind.

Guide to the Static Displays . . . .

William Mallinson and Sons, Ltd. (107). This stand illustrates the use of Mallite and grain-balsa laminates in aircraft construction. Photo-transparencies show 20 different aircraft types which incorporate these laminates, either as bulkheads, cabin linings, etc., or as floors installed originally, incorporated in design, or fitted as a replacement.

Manchester Oil Refinery, Ltd. (133). Lubrication and hydraulic oils and non-destructive crack and flow detection inks.

Marconi's Wireless Telegraph Co., Ltd. (21 and 22), **Marconi Instruments, Ltd.** (20 and O.D.S. C), **Canadian Marconi Co., Ltd.** (19), and **Amalgamated Wireless (Australasia), Ltd.** (23). Exhibits include the new SD.1015 radar display unit which provides both raw and synthetic radar information on the same PPI tube; the SD.1016 tabular display unit which converts digital information into PPI characters; the SD.701 surveillance radar display console; the Sixty Series VHF airborne radio and navaid equipment; the AD.308 radio teleprinter receiver; the AD.2300B Doppler Navigator; and the Skyranger HF transceiver and the Skyphone VHF transceiver for use in light aircraft. The Canadian Marconi CMA–623 Doppler sensor, the CMA–601 navigation computer and the Type CMA–101/201 HF communications equipment are also shown.

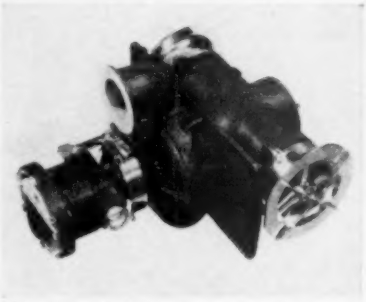
Marston Excelsior, Ltd. (136 and O.D.S. V). Brazed light alloy, titanium and stainless steel heat exchangers; flexible tanks for fuels, oils, water, etc.; and cooling devices for electronic equipment are among the products of this company. Non-metallic items comprise reinforced plastic radomes, radar reflectors and laminated plastic fabrications.

Martin-Baker Aircraft Co., Ltd. (237). On show this year are two of the company's latest production seats—a Mk. 4MSA as installed in the Blackburn Buccaneer and a Mk. H5 for the McDonnell F4H Phantom 2 of the United States Navy. In addition to the two ejection seats, there are sectionalised items such as the personal equipment connector and a time-release mechanism.

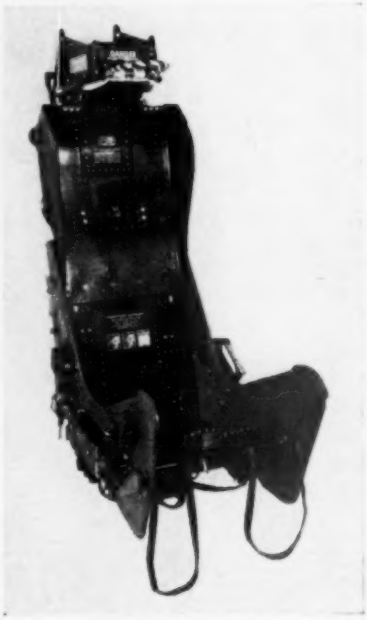
Metachemical Processes, Ltd. (144). Electrochemical, metallurgical and electro-depository services for the aircraft industry.

Micanite and Insulators Co., Ltd. (199). See Associated Electrical Industries, Ltd.

This assisted-evacuation crew seat exhibited by M.L. Aviation is designed to help fully equipped aircrew leave their seat while subjected to *g*-forces.



A Lucas double-ended fuel boost pump. It has a maximum flow of 6,000 g.p.h. and operates at a maximum pressure of 30 p.s.i.



The Martin-Baker Mk. 4MSA ejection seat for the Blackburn Buccaneer.

Microcell, Ltd. (52 and O.D.S. 12 and E1). On display is a retractable 24-tube rocket launcher; a 37-tube pylon-mounted rocket launcher; the double Travellite Mk. 2 economy class seat; the Double Executive first-class seat; a fully portable oscilloscope; and Plasticell expanded polyvinyl chloride.

Ministry of Aviation (A, O.D.S. 2, R.D.S. and M.P.). One of the features of the Ministry's main stand is safety in the air. This display includes the present U.K. airways system, radar coverage and navaids; the R.A.E. head-up instrument display; and a moving map presentation of navigational information. A model is displayed showing what a three-stage satellite launcher, based on Blue Streak, might look like. Outside there is a demonstration by the M.o.A. Air Traffic Control Experimental Unit; the Jaguar three-stage hypersonic test rocket; an Apollo series rocket-launched free-flight model aircraft; a spinning disc fuel atomiser; model of an artificial satellite tracking radar; and a 3-ft. dia. solid-propellent rocket motor.

Mitchell Hydraulics, Ltd. (111). A working assembly of hydraulic servo valves comprising a ram driving a resistive spring load at the direction of an electro-hydraulic single-stage valve, or by way of a two-stage servo valve, in which case the input linkage is purely mechanical. A further working unit, one of a range of hydraulically driven grinding spindles.

M.L. Aviation Co., Ltd. (41 and O.D.S. G). Activities in the electronic, electrical and mechanical fields, embracing design, development and manufacture of guided-weapon handling and cooling equipment, mobile and static air conditioning, dehumidification and pressure-testing equipment. Also air transportable engine carriers, armaments, simulators and target-towing equipment. Smaller items include pressurized helmets, high-pressure couplings, plastics, cable cutters, ejection mechanisms and electro-mechanical releases.

Mollart Engineering Co., Ltd. (79). Exhibited this year is a full range of universal joints including the heavy duty halo ring type, together with a range of jigs, tools, gearboxes and other precision aircraft assemblies.

L. M. Van Moppes and Sons (Diamond Tools), Ltd. (O.D.S. 5). The range of Diatube diamond drills for precision drilling in concrete and masonry are augmented this year by the addition of a special "pancake" bit. This has been designed to drill rapid and accurate holes on runways and aprons for the insertion of lights which can be fitted flush with the surface.

Morfax, Ltd. (106 and O.D.S. U). Examples of work undertaken over the last year, such as custom-made metal expansion bellows, sheet metal work, routing and other special projects. Engine servicing stands; strip/build stands; engine air, road and rail transportation stands, etc., are exhibited in the equipment park.

Murex Welding Processes, Ltd. (7 and O.D.S. I). Standard ground power units as employed in the starting and servicing of all types of aircraft.

Murphy Radio, Ltd. (174). On display is a new automatic control closed-circuit television camera and monitor; automatic-landing leader-cable aircraft equipment; and the MR 347 transportable radar transponder beacon for use with Rebecca.

D. Napier and Son, Ltd. and **Napier Aero Engines, Ltd.** (M.). One of the principal engine exhibits is an Eland turbo-prop engine "exploded" to demonstrate the ease with which major components can be changed. Also on show is a Gazelle free turbine; a complete Gazelle engine-change-unit as supplied for installation in a helicopter; and a range of Napiercast precision castings. Spraymat exhibits include a prefabricated helicopter heater mat, and the Sierracote process for electrically heating windscreens is demonstrated by a VC10 flight deck side window.

Negretti and Zambra, Ltd. (160). On display is the company's new Series 6 fuel flow meter and integrator designed for engine mounting where high fuel temperatures are encountered, together with temperature and pressure units and capsule stacks for control purposes. There are also pressure switches; gauges for boost, altitude and pressure; test-bed thermometers; test barometers; and meteorological instruments.

Louis Newmark, Ltd. (188). Manufacturers of autostabilizers, autopilots and navigational aids for helicopter and fixed-wing types, including transistorized units.

Newton Brothers (Derby), Ltd. (154). Products include automatic carbon-pile voltage and current regulators, including transistorized versions; rotary transformers and converters; 400 c.p.s. rotary inverters; and servo-motors.

Normalair, Ltd. (227–229). On display is a wide range of pressurization, air conditioning and oxygen breathing equipment intended to illustrate the scope of the company's activities and to emphasise the ability of Normalair to design, develop and manufacture complete, integrated, cabin-atmosphere control systems for all classes of civil and military aircraft. Three items being shown for the first time at Farnborough are the Transall C.160 two-speed cabin air compressor; electro-pneumatic pressure control equipment for the VC10; and a vapour cycle cooling pack also for the VC10.

Optical Measuring Tools, Ltd. (58). The emphasis of this stand is on optical dividing equipment and includes the company's complete range of indexing tables. A new 15-in. universal projector is also on show for the first time.

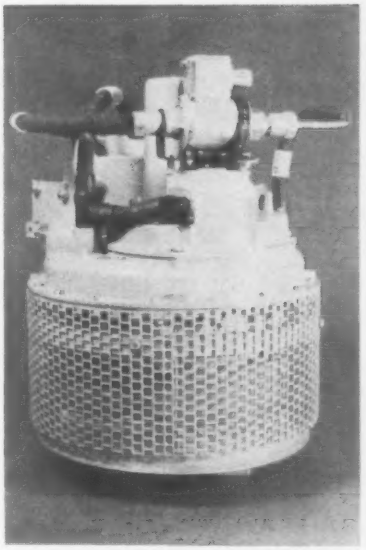
Palmer Aero Products, Ltd. (51). Two recent developments—Penflex convoluted PTFE flexible pipe, and an automatic process for orbitally welding preformed pipes to end fittings—are among a comprehensive display of products and services featured on this stand. Other items include Palmer-Parmatic aircraft filters; a range of pipes; and rubber mouldings and extrusions.

R. and J. Park, Ltd. (246). Photographic and model display of aircraft and other items of major interest that the company has packed during the past 35 years.

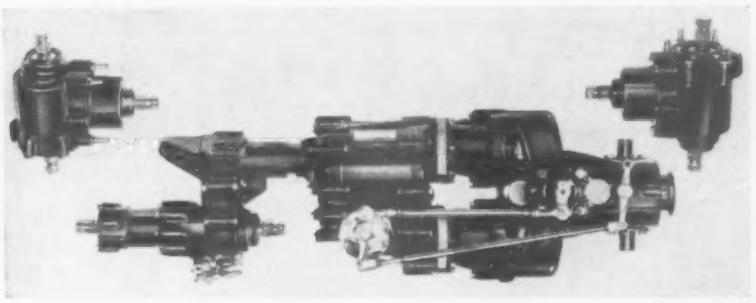
Plannair, Ltd. (217). This display includes pilot-suit air supply blowers under development for the U.S. Navy and the U.S.A.F.; five blowers designed for installation in the Vickers VC10; a portable blower-heater for windscreen demisting, etc.; and the company's new Pres-Loc quick-release spring-loaded panel fastener.

The Plessey Co., Ltd. (91), **Plessey International, Ltd.** (92) and **Wireless Telephone Co., Ltd.** (93). A 40 kVA generation system similar to that being installed in the VC10 and proposed for the B.A.C. One-Eleven; telecommunications equipment; static inverters; the Raven AC rotary geared motor unit; new Types P and R relays; pneumatic actuation and control system for V/STOL aircraft employing the rotating nozzle principle; fuel and hydraulic pumps; a representative range of aircraft electrical connectors; and electronic components.

Power Auxiliaries, Ltd. (78). This company produces flexible metallic hose and ducting; survival fittings; quick-release self-sealing couplings; and associated equipment.



This electrically actuated, pneumatic discharge valve forms a basic component of the new Normalair electro-pneumatic pressure control system which is being installed in the Vickers VC10.



This Plessey pneumatic actuation and control system for V/STOL aircraft requires only bleed air from the engine it controls.

Precision Forgings, Ltd. (214). Formerly the Blade Division of Garringtons, Ltd., this company is exhibiting typical examples from its range of blade production, together with its latest developments.

Precision Rubbers, Ltd. (60). Typical examples of the company's products such as "O" ring seals, sleeves, brushes, diaphragms; aircraft electrical components; and extrusions and rubber-to-metal bonded parts in natural, synthetic and silicone rubbers to various specifications.

Premier Precision, Ltd. (89). Activities include the design and manufacture of prototype equipment special-purpose machines; precision tool making; and the assembly of engine and auxiliary equipment.

Pritchett and Gold and E.P.S. Co., Ltd. (244). The highlight of this stand is the Dagenite Type ED24V battery for civil aircraft. A 12V version of this unit is also shown, together with a number of other 24V aircraft batteries.

R. B. Pullin and Co., Ltd. (216). Electrical and electronic engineers; scientific instrument manufacturers; gyroscopic apparatus.

Pye Telecommunications, Ltd. (187). Major exhibits include a fixed 50-watt VHF station; a VHF ground-to-air receiver; a four-channel VHF monitor receiver, the Pye ILS remote control and monitoring console; and the Ranger mobile VHF transistor radiotelephone.

The Pyrene Co., Ltd. (55 and O.D.S. F). An extended range of fire safety equipment for aircraft and airfields, including new forms of fire-detecting and fire-indicating units. There is a Pyrene Mark 6T aircraft crash tender in the equipment park.

Rank Cintel, Ltd. (269). On show is the P.E.E.P. head-up instrument display system, electronic photographic printers for aerial survey work and various electronic instruments.

The Rawlplug Co., Ltd. (155). Rawlnut shock and vibration-proof fixing devices for aircraft are featured, together with several other types of all-metal "blind" fixing devices.

Redifon, Ltd. (27 and 28). The major portion of this double stand is devoted to communication equipment and includes the A43R UHF military parkset; the G42R SSB/ISB transmitter; the GR410 100-watt radio telephone; the G190 VHF ground-to-air transmitter; the Redifax meteorological facsimile receiver; and the Radic computer.

Rellumit (London), Ltd. (119 and O.D.S. J). Products include microfilters fitted with Lenticulaire-type elements for aircraft refuelling; bulk installation filters; Rellumit Fipoca filters; air eliminator and coarse filter combined unit; floating suction loading arm; underwing pressure fuelling hydrant dispenser; one-man-operated motorized hydrant dispenser for overwing fuelling; mobile hose elevator unit for underwing refuelling; and water separator microfilter unit.

Reynolds (Packaging), Ltd. (40). This company produces various types of packs for aircraft, electronic and electrical equipment.

Reynolds Tube Co., Ltd. (249). A display of the company's specialized products, such as flash-welded rings and precision hollow extrusions, including rectangular dish rings; air starter cartridge cases; steel pressure vessels; and hydraulic cylinders.

R.F.D. Co., Ltd. (108). Products represented on this stand include the 26-seat Universal liferaft; the S.S. Mk. 5 single-seat liferaft; pneumatic aircraft lifting bags; airhouses; and lifejackets.

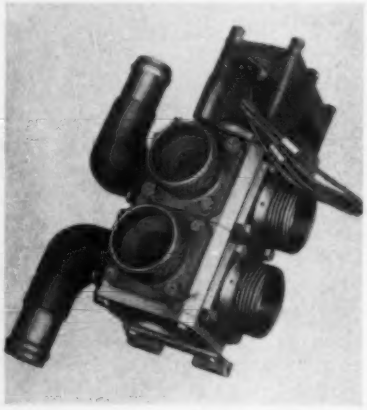
The Marconi radar display suite, comprising the SD 1016 tabular display unit and the SD 1015 combined radar/synthetic display unit.

Guide to the Static Displays . . . .

Rolls-Royce, Ltd. (K). Exhibits include a mock-up of the Conway R.Co.42 by-pass engine under development for the Vickers VC10; the Spey by-pass turbojet for the D.H. Trident and the B.A.C. One-Eleven; the Tyne R.Ty.11 turbojet; a VTOL presentation containing two RB.108 and one RB.145 jet-lift engines; and the O-200A, O-300 and IO-470D Continental piston engines.

S. Grahame Ross, Ltd. (266). A feature of this stand is a working model simulator showing the application of the company's hydraulic equipment to this use. A new electro-hydraulic actuator and a range of hydraulic cylinders and pneumatic-hydraulic intensifiers are also displayed.

Rotax, Ltd. (126 and O.D.S. 15 and B). Among the equipment on display is a new range of 400 c.p.s. static invertors utilizing silicon controlled rectifiers; Tyne engine starter unit; aircraft generating-equipment control and protection units; new switchgear and motors; and a range of rotary and linear actuators.



A Saunders Mk.4 Multiway spherical plug valve unit. It consists of two multiway valves driven in tandem from one motor.

Rover Gas Turbines, Ltd. (O.D.S. 14). Exhibits comprise the Rover airborne auxiliary power plant and a T.P./90 turboprop engine mounted in a wing section.

Royston Instruments, Ltd. (167). This company produces electronic, electro-mechanical and optical instruments—in particular, data-recording and processing equipment such as the MIDAS flight and crash recorder.

An exploded model of the Short Seacat SAM. Sections from l. to r. are head-containing fuse; warhead; electronic pack—containing control and guidance units; servo units; tandem motor—forward half containing sustainer charge and rear half, the boost charge. Tail stabilizing fins are attached to the rear of the motor casing.

Rubery, Owen and Co., Ltd. (67). Manufacturers of aircraft fasteners.

L. A. Rumbold and Co., Ltd. (283). Exhibit comprises the company's new range of high-density tourist seats, series 957 and 960; the Foldaway seat, series 980; a helicopter V.I.P. seat; a Friendship pilot's seat; and a Herald passenger seat, series 931.

Salford Electrical Instruments, Ltd. (35). Products include instruments, thermostats and circuit breakers.

W. H. Sanders (Electronics), Ltd. (134). Activities cover aircraft radar components, electronic welding apparatus and wave guide test equipment.

Sangamo Weston, Ltd. (72). A representative range of Weston instruments are being exhibited and include those for indicating temperatures, pressures and control-surface positions, turbine speeds and electrical power, together with navigational indicators, ice-warning system and ground test sets.

Saunders Valve Co., Ltd. (296). Prominence is given to the many variants of the company's motorized spherical plug valve. Other examples include the multiway spherical plug valve; a new high-pressure (15,000 p.s.i.) valve; the Type S valve; and electrically operated flap-type non-return valve.

W. Bryan Savage, Ltd. (186). Control console for vibration testing, incorporating automatic vibration exciter control, *g* meter, remote switching and controller facilities, etc.; a 10-kilowatt low-frequency amplifier; and a Ling type 245 2,250-lb. thrust vibrator.

The Schermuly Pistol Rocket Apparatus Ltd. (14). New developments on display include a chute-launched parachute flare for light aircraft and helicopters for emergency landings, search and rescue purposes; radar reflective hand signals and signal cartridges; and various stores, such as yellow smoke wind-direction cartridges.

Sciaky Electric Welding Machines, Ltd. (50). The main attraction of this stand is the first demonstration of a fully operational electron-beam welder which, in addition to welding by fusion, may also be used for melting, grain refining, stress relieving, out gassing, cutting, overlaying, metallizing and vacuum brazing.

On the Smiths Aviation Division display can be seen this Kelvin Hughes servo-driven precision altimeter for the Vickers VC10.

Tom M. Scotney, Ltd. (94). Inter-factory transportation box for rotor blades; various types of containers illustrating methods of protection of components during transportation and storage; mobile transit stand of tubular construction; and examples of pre-packaging for the Services.

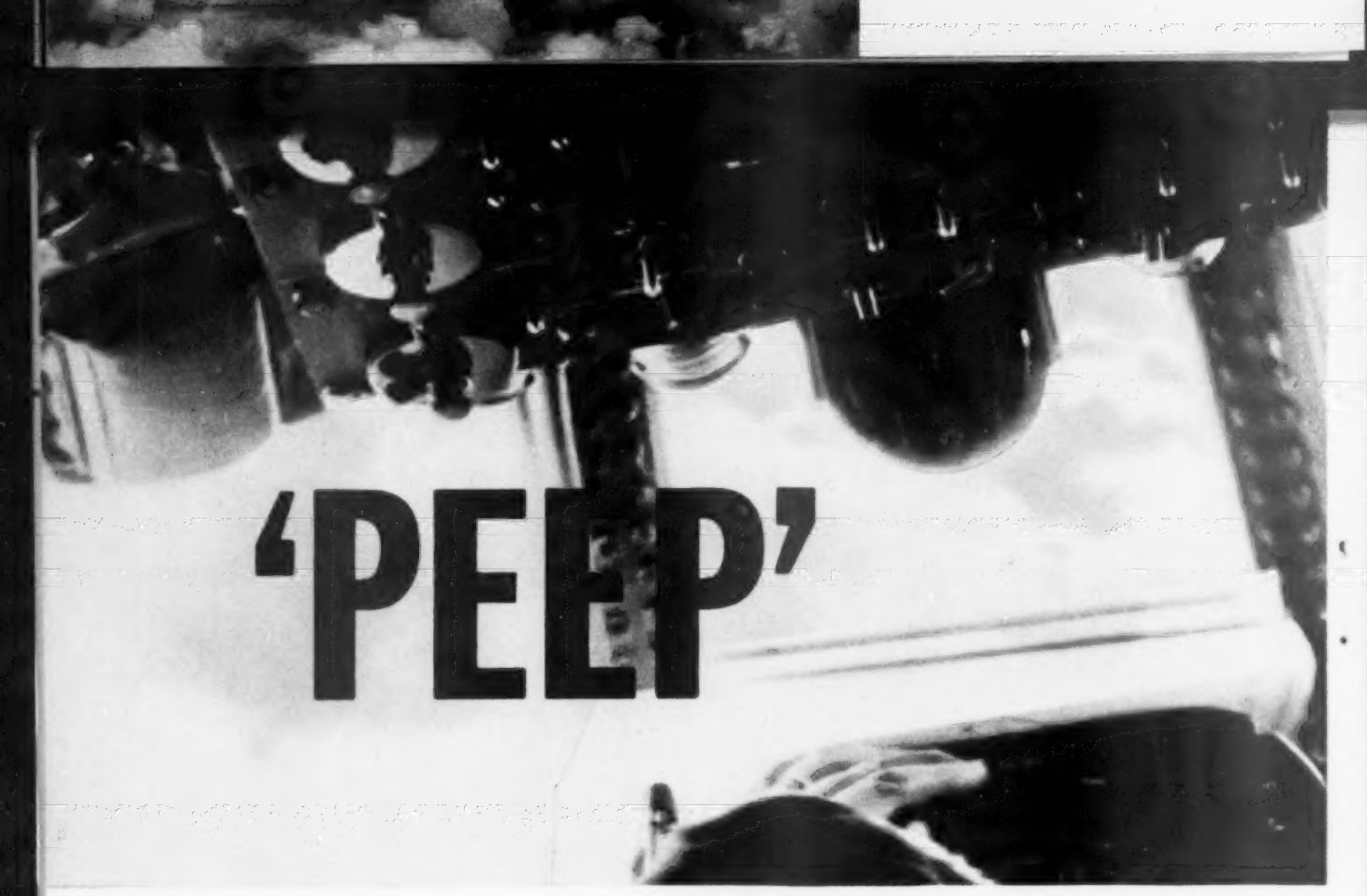
Scottish Aviation, Ltd. (F). This display features the Series 3 Twin Pioneer. Powered by two 640-b.h.p. Alvis Leonides 531/8B engines, this STOL transport is in operation in countries and undeveloped areas throughout the World.

Four Rolls-Royce Tyne turboprops power the Short SC.5 Belfast strategic freighter, 10 of which are on order for R.A.F. Transport Command.

AN AIRCRAFT SEAT IS SOMETHING SPECIAL

Half the fun of flying is doing things in style. Airline operators know that. Passengers expect it and Airlines all over the world know that Microcell aircraft seats are built the way their passengers expect them to be. Comfortable, of course, but with built-in touches which make Microcell seats something special even by aircraft seating standards.
Full data on the complete range—from the sumptuous Executive De Luxe to the comfort-on-a-budget "Travelite" ultra-lightweight seats—is available from the address below.

MICROCELL LIMITED
(A subsidiary of BTR Industries Limited)
9 Kingsway London WC2 COVent Garden 1262

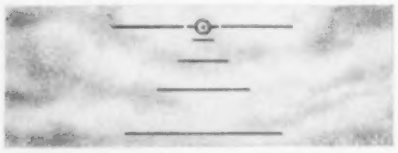


'PEEP' integrates these five

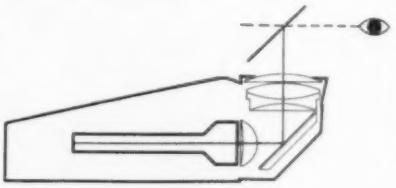
The Cintel Pilot's Electronic Eyelevel Presentation system (PEEP) is a radical new method of presenting to the pilot essential flight data in an easily seen and assimilated form.

PEEP'S CONCEPTION is based on the philosophy that the ideal place to present flight data to the pilot is directly in front of him, at eye level, in line with the aircraft's flight path.

On this basis, Cintel have developed for the Ministry of Aviation the PEEP system whereby information enabling the aircraft to be flown on course, at the correct height and airspeed, is presented directly in front of the pilot — on the windscreen. The display is transparent, allowing objects to be seen *through* the display, and the pattern is collimated; i.e. focused at infinity. The information is, therefore, focused at the correct distance for the pilot when he is looking ahead of his aircraft . . . appearing as if it were part of the sky path outside.

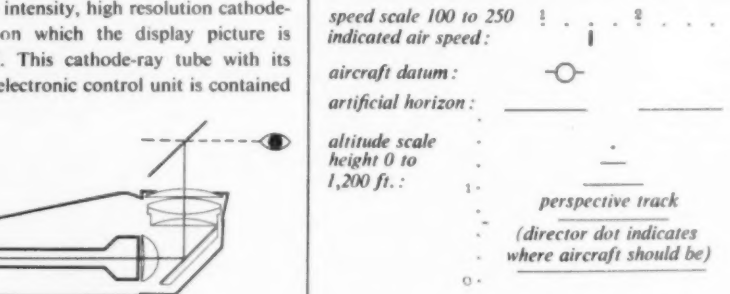


The heart of this revolutionary system is a small, high intensity, high resolution cathode-ray tube, on which the display picture is reproduced. This cathode-ray tube with its associated electronic control unit is contained



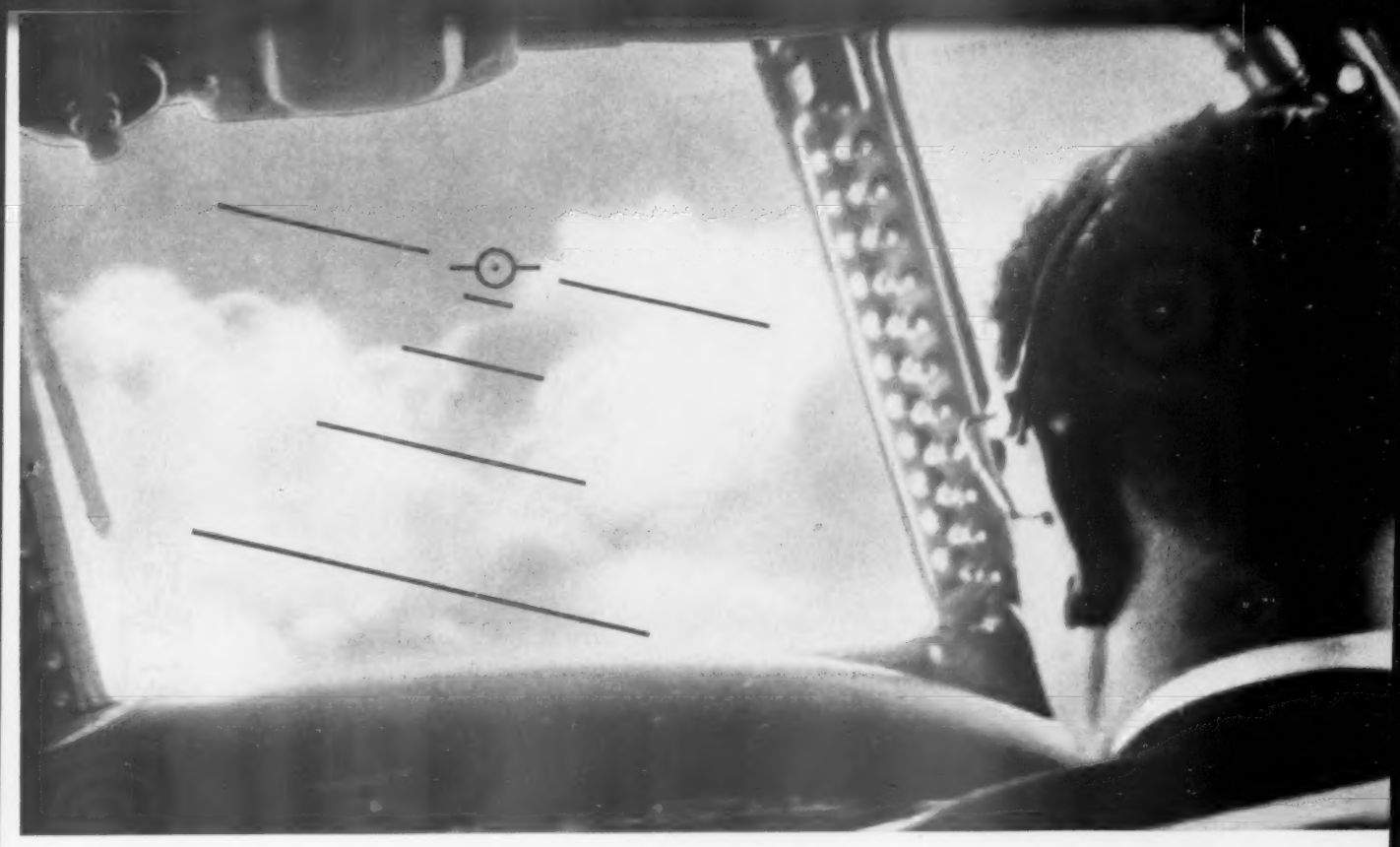
within a compact, lightweight casting known as the Pilot's Display Unit. Combined with the unit is a lens system which projects an image of the display picture on to a reflecting screen situated at eye level in front of the pilot, or on to the windscreen itself. The amount of information presented by the display is dependent upon various operational requirements.

The pattern, with the symbol identification:



The *air speed* and *altitude* scales can be selected to appear on the display as and when required.

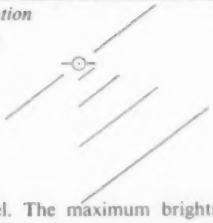
The main advantage of the PEEP system is that the information presented is self-evident and is easily assimilated. Eyestrain on the part of the pilot is considerably reduced with the removal of the need for frequent and hurried refocusing from the infinity of the outside view to the close proximity of his



normal flight data sources!

SBAC STAND 269

Banking information in relation to the aircraft datum



instrument panel. The maximum brightness of the display is sufficient to render it visible against the brightest cloud edge. Yet it can be automatically controlled to give a very low brightness level for night flying. Once set by the pilot, this brightness level can be made to vary automatically, adjusting itself to changing

Pitch information in relation to aircraft datum

conditions of natural background illumination. The system, via its coupler unit, will accept all normal signal sources associated with conventional meter presentation, and can be so arranged as to present *absolute* bearing, height, speed, etc., or *deviation* from a given set of data such as bearings etc.

Storm warning and collision warning can be displayed if the relevant radar information is available, and other information symbols can be added as and when desired.

The equipment is completely transistorised, and meets all the stringent requirements of military users. Displays applicable to helicopters, or VTOL aircraft, can be provided. **Full technical details are available on request.**

CINTEL
aircraft equipment
division

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SPECIAL AIRCRAFT STEELS
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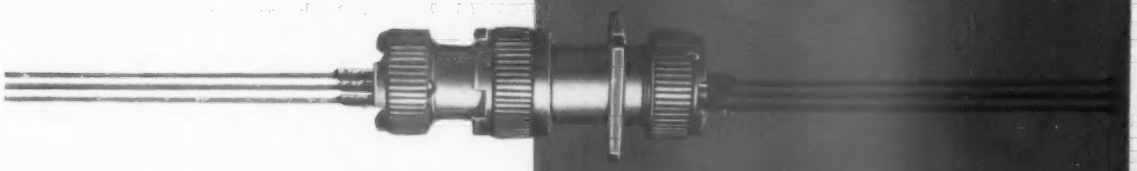

Only Hellermann 'Bambi' Series Miniature Connectors have all these outstanding features —

1. Crimped connections that can be inspected after assembly
2. Shell sizes that are interchangeable with American specification 26482
3. 2 ranges—4 amp and 6 amp for the same shell size
4. Positive location of the pins and sockets within rigid plates
5. Mismating prevented by positive location of polarising pin
6. Moulded resins and synthetic rubber insulation common to both plugs and sockets
7. Design allows for moulded inserts to be used in fixed or free shells
8. Saves weight and space

Hellermann 'Bambi' Pressure Glands

Ancillary to the 'Bambi' Miniature Connectors enabling cables to be sealed into bulkheads or equipment for miniature work where an unbroken circuit is required.

Shell sizes are the same as for the Bambi Miniature Connectors.

Hellermann HAN Type 2 series Crimped and Sealed Connectors

Crimped connection with conductor and insulation crimped available up to 20 AWG.

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Visit Hellermann, Stand No. 172
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A member of the Bowthorpe Holdings Ltd. group of companies

new-
for
high temperature
and
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AVICA

V-Flange couplings

These advanced, light weight, stainless steel couplings have been designed for current and future trends in air duct systems. The coupling consists of mating flanges, seal and light weight clamp.
Metallic or rubber seals are available to suit different applications and temperature ranges. The flanges are designed for seam or butt weld attachment to varying gauges of tubing or the unique AVICA mechanical attachment method can be used instead of welding.
Technical data will gladly be sent on request.

Another product in the AVICA *range of piping and ducting components and systems.*

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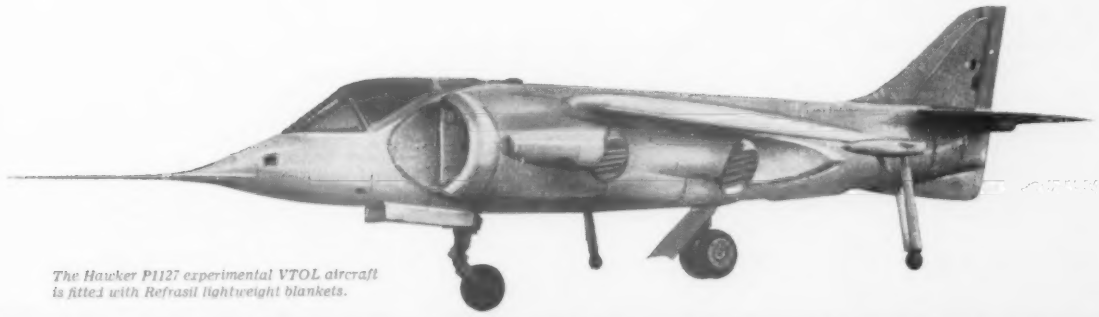
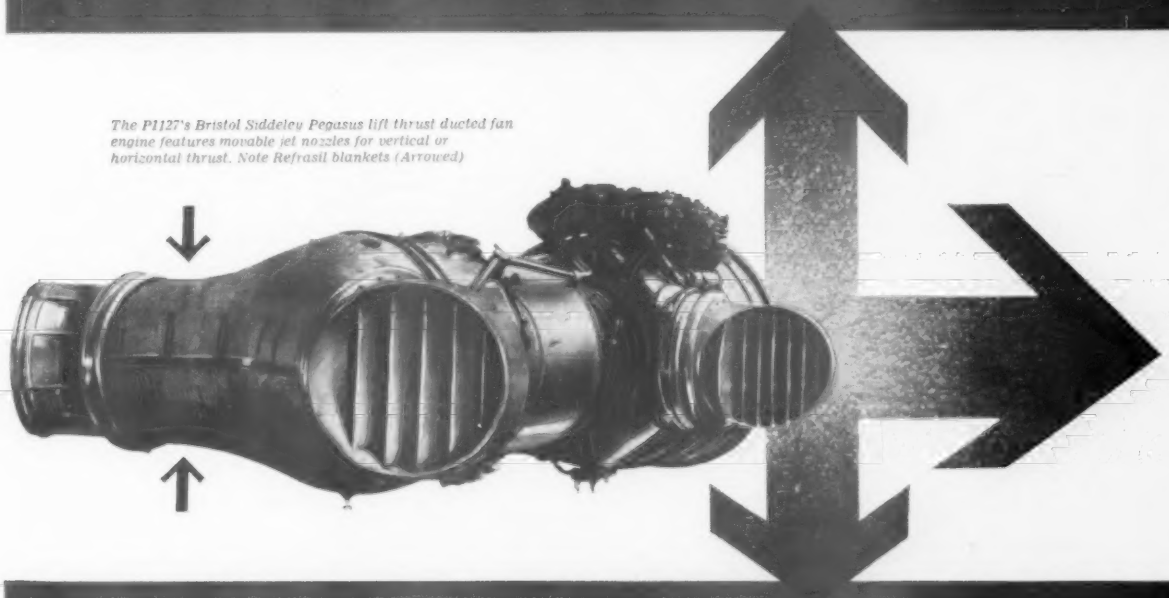


The Hawker P1127 experimental VTOL aircraft is fitted with Refrasil lightweight blankets.

FOR V.T.O.L. OR CONVENTIONAL AIRCRAFT

The P1127's Bristol Siddeley Pegasus lift thrust ducted fan engine features movable jet nozzles for vertical or horizontal thrust. Note Refrasil blankets (Arrowed)



... REFRASIL INSULATION

STAND
NO 267

SINCE THE EARLY DAYS of jet aircraft, Refrasil has played a vital part in high temperature insulation. Today Refrasil is used in most experimental projects, including the Hawker P1127 VTOL aircraft, as well as the majority of British production engines and aircraft. Why? Because Refrasil blankets can withstand continuous temperatures of 1,000°C. Further, they are precision made to the specific needs of a development programme or other application. A prototype shop is an invaluable part of the Design, Technical, Advisory and Maintenance services operated by Darchem Engineering before and after sale. And, another production point: no aircraft programme has ever been held up for deliveries. Whenever you have an insulation problem consult Darchem Engineering.

DARCHEM ENGINEERING LTD

"Who can tell me this?" said the M.D. with a superior smile. "If one man with one tool can tighten one nut, how many men would you need to tighten eight nuts?"

"Couldn't it be a woman, sir?" asked one Little Horse who had been reading Lolita under the desk.

"Depends whether it's at overtime rates," said the pedant of the class.

"Wrong, wrong," cried the M.D. triumphantly, "you're all wrong! The answer is NONE, because it's a Desoutter eight-spindle multiple nutrunner, controlled by Lang Pneumatic Valves and built by Carter Stevens into an automatic machine!"

"I think schoolmasters are grossly overpaid!" said one Little Horse after a long blank silence, "let's go on strike."

The Desoutter Group

DESOUTTER BROS. LTD.,
LANG PNEUMATIC LTD.,
CARTER STEVENS (AUTOMATION) LTD.,
DESOUTTER PRODUCTS LTD.

CRC/DT/346

Guide to the Static Displays . . . .

The maid-of-all-work Short SC.7 Skyvan light transport, now under construction, will have a 1½-ton payload.

Semiconductors, Ltd. (76). High-frequency germanium and silicon transistors are featured on this stand.

Serck Radiators, Ltd. (223). In this exhibit air- or fuel-cooled engine and hydraulic control coolers are shown together with air- and oil-heated fuel radiators and de-icing heat exchangers.

The Sheffield Smelting Co., Ltd. (291). The exhibit covers special alloys of silver solders used on aircraft, guided missiles and rockets; and a large variety of precious metal contacts and assemblies, both wrought and sintered, which are produced to the special requirements of the aircraft industry.

Shell-Mex and B.P., Ltd. (220–222). Representing the Shell International Petroleum Co., Ltd., B.P. Trading, Ltd., and Shell-Mex and B.P., Ltd., these three stands display new fuel dispensing equipment designed to meet the requirements of private and executive aircraft.

Short Brothers and Harland, Ltd. (I, 224, O.D.S. O and M.P.). Models of the swing-nose Belfast and Short-designed fully automatic freight terminal; 11-ft. section of the two-deck civil version of the Belfast, illustrating typical freight/cargo arrangements; VTOL display; and Seacat missile system.

Siebe, Gorman and Co., Ltd. (8). This exhibit includes a new fire-fighting suit in aluminized asbestos with a heat-insulating under-suit; a self-contained compressed-air-operated circular saw for cutting into crashed aircraft; and oxygen breathing equipment.

Simmonds Aerocessories, Ltd. (190). Aeronautical products include Nyloc stiffnuts, spire nuts and fasteners.

Skyhi, Ltd. (275). Products include aircraft service jacks and salvage equipment; inhibitor guns; aircraft skates; hydraulic loaders; and Skyflex flexible hose units.

Smart and Brown (Machine Tools), Ltd. (181). In addition to the company's standard ranges of plugs and sockets, etc., new items on show comprise prototype BMS connectors incorporating the monobloc construction together with a positive pin retention; Deutsch DTK range of miniature bayonet lock connectors; and Deutsch hermetic receptacles with socket contacts.

Herman Smith, Ltd. (139). Specialists in heat exchange equipment. Also precision sheet metal components and assemblies in light alloy, stainless and heat resisting steels.

Smiths Aviation Division embracing Smiths Aircraft Instruments, Ltd. (2), Kelvin and Hughes (Aviation), Ltd. (3), K.L.G. Sparking Plugs, Ltd. (1), and Waymouth Gauges and Instruments, Ltd. (4). The main part of this exhibit consists of an aircraft flight control system and features SEP.5 multiflex autopilot components for the Trident and Belfast. Other equipment on show includes a precision altimeter; split-pointer airspeed indicators; engine instruments; fuel contents gauging systems; para-visual directors; gyroscopes; periscopes; light aircraft instrumentation; and K.L.G. engine equipment.

Smith's Stamping Works (Coventry), Ltd. (39). Exhibit consists largely of compressor wheels, turbine discs and other large aero-engine components in stainless and heat-resisting steels, and in Nimonic and titanium alloys.

The Solartron Electronic Group, Ltd. (192). A feature of this stand is the first public showing of the company's commercially produced fully transistorized radar simulator system. Other exhibits include a digital data recorder; a new pulse generator which is shown in conjunction with a new double-beam oscilloscope; an analogue computer; and a high-speed printer.

Solus-Schall, Ltd. (175). Products include Magnaflux and Zyglo crack-detection units; Eresco portable X-ray units, and associated equipment.

Southern Forge, Ltd. (196). Display of aluminium-alloy drop forgings for aircraft components.

Southern Instruments, Ltd. (251). Products on display include portable transistorized tachometers; the Drayton Southern Omni-guard equipment protection system; digital counters; Cathode Follower measuring equipment; and a number of VHF radio telephones for airport applications.

S.P.E. Co., Ltd. (274). Full range of AC and DC fuel booster pumps with representative air-turbine-driven in-flight refuelling pumps. Water/methanol, water/glycol, water and H.T.P. fuel pumps are also displayed, together with fuel recuperators, hydraulic reservoirs, float-level control valves, non-return valves, cabin-heater system pumps, fluid level switches and a full range of Flylite flexible hoses, couplings and fittings.

George Spencer Moulton and Co., Ltd. (265). Rubber products under the two headings of "extreme temperature service" and "anti-vibration and shock absorption" are exhibited on this stand. They include a jet-pipe mounting; protector billows; hot gas and cowling seals; and a helicopter drive shaft coupling.

Sperry Gyroscope Co., Ltd. (100 and M.P.). Aircraft instrumentation is a major feature of this stand and includes a model of the Trident flight deck illustrating Sperry functional instruments for this aircraft, a twin gyro reference platform and the SP3 autopilot. Sperry Vickers hydraulic components; a missile accelerometer; servo units; and the Seaslug control-system test equipment are also exhibited.

Spurling Motor Bodies, Ltd. (O.D.S. 10 and M). Manufacturers of aircraft ground equipment.

An impression of the Super VC10, 30 of which are on order for B.O.A.C. to follow 15 of the basic version. The first VC10 is due to fly next year.

Guide to the Static Displays . . . .

Standard Telephones and Cables, Ltd. (156–159). The two main items on these stands are a new lightweight VHF communication and navigation system particularly suitable for executive and light aircraft, and a new ground-based direction finder using the Doppler technique. A scale model of an S.T.C. VOR beacon and associated equipment; an animated display of the Stantec computing system and electronic components are also featured.

Steel, Peech and Tozer, Ltd. (123). Displays include finish-machined rings in Fortiweld steel as used in aircraft gas-turbine engines; profile-rolled rings; a working model of a steelworks cogging mill; and photographs illustrating the new plant which is being installed at the company's works.

Sterling Metals, Ltd. (5). Major exhibits comprise sand castings, such as the Bristol Siddeley Sapphire air intake extension and the Dunlop Argosy landing wheel half hub, and a comprehensive collection of smaller gravity die and precision moulded castings in aluminium and magnesium alloys.

J. Stone and Co. (Charlton), Ltd. (230). Castings in aluminium, magnesium and copper-based alloys; castings and forgings in high-conductivity copper and copper-base materials.

J. Stone and Co. (Deptford), Ltd. (231). Exhibits include a display devoted to various types of light alloy and other non-ferrous rivets, washers, etc.; automatic voltage regulators; and Stone-Vapor thermostatic controls and relays as used on the Viscount and Argosy.

Suntex Safety Glass Industries, Ltd. (101). Manufacturers of Perspex cabin windows; canopy mouldings; bullet-proof glass windscreens; rigid p.v.c.-moulded panels; and clear acrylic tubing.

Super Oil Seals and Gaskets, Ltd. (63). The stand features various types of Aeroquip hose with detachable reusable end fittings, and SuPerfect oil and grease retainers.

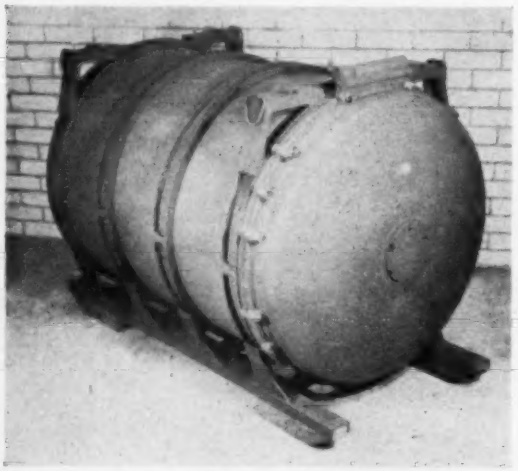
The Gloster Miles Verro Minor suction sweeper for cleaning taxi-ways, airfield aprons and hangar floors.

Taylor, Taylor and Hobson, Ltd. (264). Products cover precision measuring equipment such as the Talyron roundness gauge; Talysurf surface-measuring instruments; the Magna-Gage electronic comparator and signal-light indicator; and the Talyvel electronic level.

Tecalemit, Ltd. (177). Group exhibits include examples of high precision machining and finishing for use in aircraft control, gyroscopes and guided missiles; a range of Waveflex waveguides used in microwave transmission systems; hydraulic filters, elements and water-fuel separators; and hand extinguishers, crash tenders and complete static fire protection installations.

Technograph Electronic Products, Ltd. (173). On display is a comprehensive range of printed circuits, including production examples for de-icing elements, thermocouples, strain gauges, switches, etc.

Teddington Aircraft Controls, Ltd. (49). The exhibit includes a sectioned model of a Noelle 60 gas turbine starter; a display panel illustrating the company's contribution to the VC10; pressure regulators; hot-air and gas valves; ice-detection equipment; time switches and time-delay units; and aircraft bellows.



Manufactured by Wilmot, Mansour and Co., this aluminium pressurized container provides spring suspension of the store which is mounted on extending rails.

Teleflex Products, Ltd. (130). Examples of cable tension regulators for such aircraft as the VC10, Vanguard, Buccaneer, Bristol 188 and Hawker P.1127; lightweight low-friction pulleys and roller fairleads; and an inertia-lock airscrew harness.

Thermal Control Co., Ltd. (183). The most recent project of this company is the B.P. Aquascan equipment which detects and measures on a continuous basis the amount of undissolved water in aircraft turbine fuel.

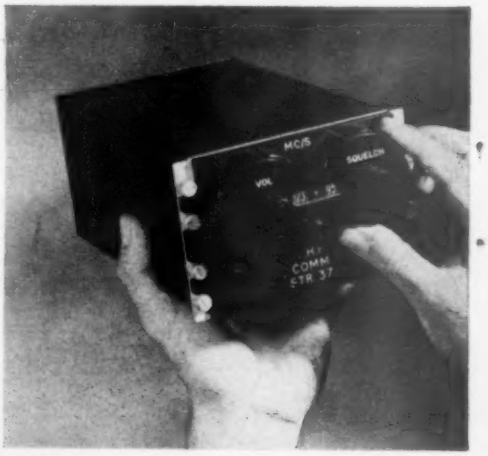
Thermionic Products (Electronics), Ltd. (290). The principal exhibit is the new transistorized Series 4 six-channel recorder for Air Traffic Control. This has been designed specifically for control organizations requiring the recording of relatively few channels, where the company's larger Series 3 equipment is not an economic proposition. There is also a live demonstration of the new Thermionic eight-speed data deck for digital recording.

Thorn Electrical Industries, Ltd. (115). Manufacturers of Plastek panels and other flight-deck illumination systems; range of passenger-facility panels, cabin roof lights and warning signs; electrical connectors and other units.

Titanine, Ltd. (207). Aircraft finishes covering the complete range of Ministry requirements with special reference to advanced high-speed designs. Protective compositions for use in the construction of aircraft, scratch-prevention coatings and contour etching schemes.

T.K.S. (Aircraft De-Icing), Ltd. (26). The main exhibit consists of a panel showing a typical T.K.S. fluid de-icing system, linked with an illuminated drawing of an aircraft indicating the location of the actual equipment on the aircraft. There is also a working distributor to demonstrate the economy and accuracy of distribution of de-icing fluid.

Triplex Safety Glass Co., Ltd. (13). Employing a five-window Vulcan canopy, the main exhibit illustrates the Triplex gold-film electrical heating method of overcoming icing at high altitudes. Vanguard, P.1127 and Buccaneer windscreens are also on display.



The new Standard Telephones STR.37 VHF transmitter/receiver designed for use in executive and light aircraft. It has 400 switched channels, the crystals being contained entirely within the switch knobs.

The Folland Lightweight fully-automatic Ejection Seat, Mark 4, is standard equipment for the Gnat Trainer which is now in quantity production for the Royal Air Force. The parachute equipment is manufactured and has been developed by the G. Q. Parachute Company in conjunction with and to the specification of Folland Aircraft Limited.

G.Q. LEADERS IN PARACHUTE DEVELOPMENT

G. Q. PARACHUTE CO. LTD., Stadium Works, Portugal Road, Woking, Surrey, England

. . . but they're fitting

PLANNAIR blowers *in the VC 10*

Performance plus quietness! That's what Vickers demanded of the blower for air re-circulation in the passenger cabin of the VC10. They called in Plannair. The result—a Cabin Air Re-circulation Blower with special impeller blades and sound deadening features which together provide a quite remarkable degree of comfort for the passengers. Whenever the problem is to provide the right amount of air in the right place, in the right way, follow Vickers' example and call in Plannair. You'll never buy a better blower!

Plannair elsewhere in the V C 10

Other Plannair Blowers in this impressive aircraft will be installed for Galley and Toilet Ventilation, Radio Rack Cooling and Louvre Boost to Cabin.

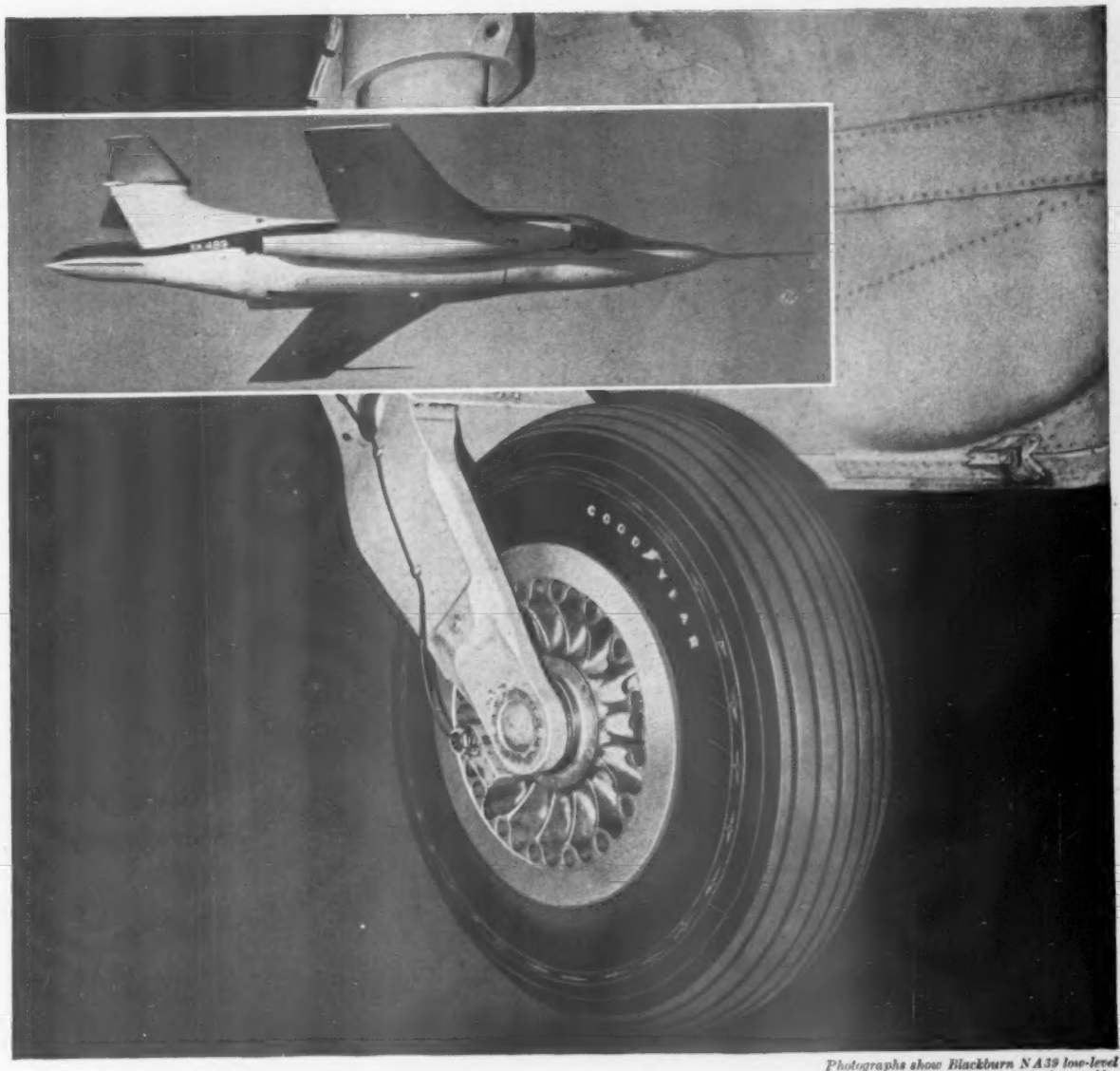
See STAND 217 at the S.B.A.C. Exhibition

PLANNAIR

PLANNAIR LIMITED

WINDFIELD HOUSE · LEATHERHEAD · SURREY · TELEPHONE: LEATHERHEAD 4091/3

PLA 51



Photographs show Blackburn NA39 low-level strike aircraft, and close-up of wheel assembly. By courtesy of Blackburn Aircraft Limited.

Blackburn NA39's will come in on Goodyear

When they land, production Blackburn NA39 aircraft will be depending on tyres, wheels, brakes and anti-skid equipment by Goodyear—proved equipment that's without peer for efficiency, reliability and economy in weight.

Brakes—maximum non-fading reserve of braking power. Light and strong. Rapid cooling. Easy to maintain.

Anti-skid equipment—prevents wheel-locking and protects braking system.

Wheels—divided at centre to facilitate tyre-mounting and withstand strain of high landing speeds.

Tyres—Ribbed Tread design with tough, high-tensile cord carcass.

We will be pleased to see you on Stand No. 69.

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AVIATION
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SERVING AVIATION THE WORLD OVER

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Power in the air demands power on the ground—the instant and completely dependable power for starting and servicing given by Murex ground power units. These diesel engine-driven equipments are designed to meet the needs of a wide range of piston, turbo-jet and turbo-prop aircraft and they are used by leading operators and manufacturers throughout the world. Standard equipments provide a peak load of 2,000 amperes for engine starting and a current of 600 amperes continuously at 28 volts for servicing and preflight checks. Other capacities and special units can be supplied. Please write for full details.

S.B.A.C. EXHIBITION Stand No. 7. Private Days 3rd—7th Sept. Public Days 8th—10th Sept. 1961

MUREX

Ground power units for aircraft starting and servicing

MUREX WELDING PROCESSES LIMITED

Waltham Cross, Herts. Tel: Waltham Cross 23636

GPU 47/820

Guide to the Static Displays . . . .

Ronald Trist and Co., Ltd. (37). Materials on display include silicone rubbers; Viton elastomer; Nitrile rubber compounds; and Butyl rubbers.

Tubes, Ltd. (260). Exhibit features tubular or hollow forgings for aircraft parts, including aero-engine compressor and turbine shafts, transmission and propeller shafts, landing gear, cylinder liners and guided missiles.

George Tucker Eyelet Co., Ltd. (117). At Farnborough for the first time, this company is featuring Pop and Imex blind rivets, together with hand, pneumatic and hydraulic blind-riveting tools. A full working model of a Pop rivet scaled up 16 times is also on display.

The Tungum Co., Ltd. (261). Manufacturers of components for guided weapons and radar equipment; springs, spinnings and machined parts.

Ultra Electronics, Ltd. (297). The two featured items are new additions to the company's range of special-purpose communication equipment. The first is an all-transistorized miniaturized radio beacon primarily intended for air/sea rescue operation, and the second is the Radiopage system for selective calling of up to 100 individual airfield personnel.

Unbrako Socket Screw Co., Ltd. (112). Latest products on display include the Milson stressed panel fastener available in three diametral sizes; the Sleev-Lock blind fastener; and lightweight plate and anchor nuts.

Vactric (Control Equipment), Ltd. (86). and **Vactric (Precision Tools), Ltd.** (87). Precision servo components, including AC motors, motor tachogenerators, DC motors, rotary switches, etc., and a representative range of Ugon sub-miniature relays developed by Le Prototype Mechanique of Paris.

Venner, Ltd. (62) and **Venner Accumulators, Ltd.** (61). Lightweight silver-zinc and silver-cadmium aircraft batteries in new easy-clean containers and hermetically sealed units for guided missile applications; electronic and communications equipment; transistorized airborne and test-bed tachometers; digital voltmeters; digital printers; and miniature packaged circuits.

W. Vinten, Ltd. (O.D.S. 9 and R). Activities cover aircraft instrumentation, reconnaissance, survey, take-off and high-speed cameras and other photographic equipment.

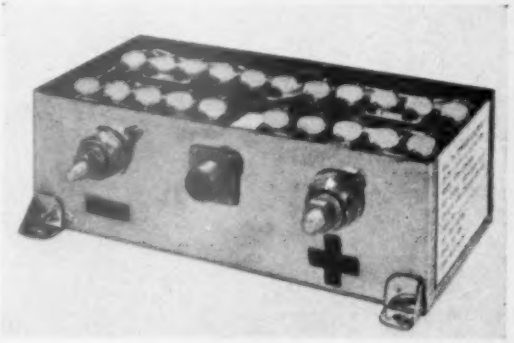
The Vickers Vigilant wire-guided anti-tank weapon seen at the moment of launch. It is intended for operation by a single infantryman.

Ward, Brooke and Co., Ltd. (252). Products include miscellaneous plastic, plastic/metal components, including terminal blocks; personal life-saving apparatus; plastic extrusions; foam-rubber mouldings; injection-mould tools.

Waymouth Gauges and Instruments, Ltd. (4). See Smiths Aviation Division.

Wellworthy, Ltd. (206). Wide variety of sealing rings, together with Spirolox retaining rings; pistons and piston rings; the Al-Fin bimetallic bonding process; and the Wellseal engine-jointing compound.

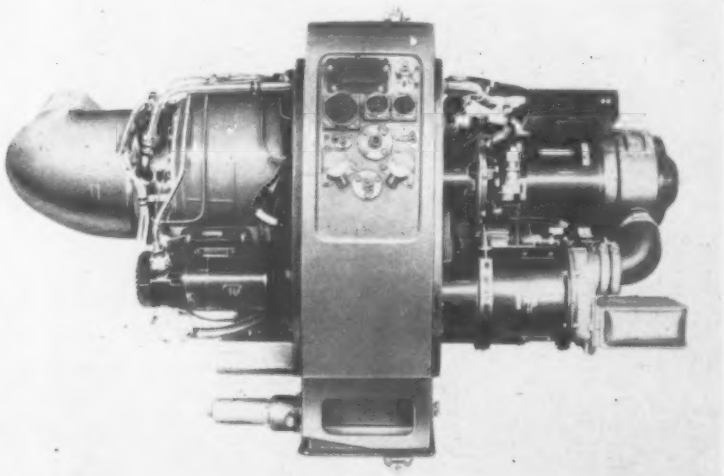
Western Manufacturing (Reading), Ltd. (6). Display includes a stall warning indicator; motors and gearboxes; fuel jettison switch; twin actuator; linear flowmeter; wax-element thermostats; hydraulic and pneumatic valves; rotary and limit switches, etc.



The Venner Accumulators Type PN. 3550/1 hermetically sealed lightweight aircraft battery designed for the emergency operation of ancillary equipment.

Westinghouse Brake and Signal Co., Ltd. (238). A feature of this stand is a demonstration of two applications of Trinistor silicon controlled rectifiers. One is a power inverter producing an output at 400 c/s; the other a compact AC power regulator rated at 13kVA incorporating a fan for forced-air cooling. Among other devices exhibited are a full range of silicon diodes; new Westinghouse H series crystal-aligned rectifier; and other selenium-type rectifiers.

Westland Aircraft, Ltd. (J and 226). The principal features of the company's main stand are a scale model 5–6-seat Wasp helicopter in civil markings, and a display centred on a large-scale model of the Rotodyne. Small models of the complete range of Westland turbine helicopters are also exhibited. The theme of the other stand is hovercraft, and the possibilities of this form of transport. Models of the SRN.2 66-passenger hovercraft and the original SRN.1 are displayed.



The Rover airborne auxiliary power plant which can be seen in the outside exhibition.

Guide to the Static Displays . . . .

Whitehouse Industries, Ltd. (242). This exhibit consists of the recently extended range of turret and industrial type Philidas all-metal one-piece self-locking nuts. Also on display are Philidas clinch nuts and single and double anchor assembly nuts, standard, thin and countersunk types.

Whiteley Electrical Radio Co., Ltd. (118). A display of specialized components encapsulated in epoxy resin and polythene; hermetically sealed transformers; and a range of moulded transformer bobbins, instrument knobs, waterproof plugs and sockets together with various monitor probes and connectors.

Henry Wiggin and Co., Ltd. (24). Nickel alloys in sheet, bar, rod, wire, tube and cast forms; Nimonic and Nimocast series of nickel-chromium alloys for high-temperature applications.

Williamson Manufacturing Co., Ltd. (99). A feature of this stand is the company's F.117 air camera.

Wilmot Breeden, Ltd. (141). On display are hollow turbine stator blades and compressor inlet guide vanes and stator blades; examples of heat exchanger matrix elements for high-temperature applications; and Pegasus servo valves and servo drive systems.

Wilmot, Mansour and Co., Ltd. (81). Exhibits include two new spring systems; accelerometers and transistorized associated equipment; an aluminium pressurized container with spring suspension of the store mounted on extending rails; and examples of lightweight cartonboard instrument packs.

Wireless Telephone Co., Ltd. (93). See The Plessey Co., Ltd.

Ordered by both the Royal Navy and the Royal Australian Navy the turbine-powered Westland Wessex is for anti-submarine warfare.

W.S. Electronics, Ltd. (271). Range of communication and other electronic equipment including a two-channel emergency transmitter/receiver; a high-altitude emergency transmitter/receiver; 12-channel lightweight VHF transmitter/receiver; multichannel airborne VHF telemetry transmitter; and an airfield security communications system.

Zwicky, Ltd. (284 and O.D.S. Q). In the outdoor display there is a Hertford refuelling unit; an Avon refuelling unit; a Tigris fuel dispenser; and a Kennet fuel dispenser. Inside there are pressure control valves; micrometric adjustable venturis; hose end filter couplings and a pressure controller; and hydrant couplings.

CLASSIFIED DIRECTORY

This summary of suppliers to the British Aircraft Industry, excluding exhibitors at the S.B.A.C. Show, Farnborough, has been condensed from Part III of "The Aeroplane Directory of British Aviation" 1961 Edition under the following headings: (1) BASIC METALLIC MATERIALS (castings, forgings, sheets, stampings, all metals in unmachined state); (2) NON-METALLIC MATERIALS (adhesives, ceramics, glass fabrics, plastics, rubber, timber); (3) PREFABRICATED COMPONENTS AND PARTS (A.G.S. parts, airframe components, sub-assemblies); (4) TOOLS AND WORKSHOP EQUIPMENT; (5) CONTROLS, SYSTEMS AND ACCESSORIES. (6) INSTRUMENT EQUIPMENT; (7) ELECTRONIC AND ELECTRICAL EQUIPMENT (includes navigational aids and communications); (8) SURVIVAL EQUIPMENT AND FLYING CLOTHING; (9) MISCELLANEOUS EQUIPMENT AND SERVICES (furnishings, maps, packing, photographic supplies, repair work, research work, seating); (10) AIRPORT CONSTRUCTION AND EQUIPMENT (airfield lighting, fire-fighting, fork-lift trucks, ground power units, passenger steps); (11) FUELS AND OILS; (12) PAINTS, CLEANERS AND FINISHING PROCESSES.

1 — Basic Metallic Materials

Aeroplane and Motor Aluminium Castings, Ltd., Wood Lane, Erdington, Birmingham. T.: Erdington 2207-9. Pressure, gravity and sand castings.

Albion Drop Forgings Co., Ltd., Foleshill, Coventry. T.: Coventry 88091-3. Forgings, stampings.

Aluminium Corporation, Ltd., 10 Buckingham Place, London, S.W.1. T.: Victoria 9671. Aluminium rollers.

Andrews Toledo, Ltd., Toledo Steelworks, Sheffield, 3. T.: Sheffield 23274. Aircraft steels.

Balfour, Arthur, and Co., Ltd., Capital Steel Works, Sheffield, 3. T.: Sheffield 22071. High-speed alloy tool and plain carbon tool steels.

Birkett, T. M., Billington and Newton, Ltd., Birkett St., Hanley, Stoke-on-Trent. T.: Stoke-on-Trent 22184. Non-ferrous castings and machined parts; Birso chill-cast rods and tubes.

Bolton, Thomas, and Sons, Ltd., Meracy Copper Works, Widnes, Lancs. T.: Widnes 2022. Boltomet copper and copper alloys.

Bramah, J. R., and Co., Ltd., Devonshire St., Sheffield, 3. T.: Sheffield 24228. Aluminium alloy; Nimonic, etc., fabrications; Argon welding, etc.

Brown Brothers (Metals), Ltd., Warwick Works, Downs Rd., London, E.5. T.: Clissold 2561. Alloy, carbon and stainless-steel bars and carbon steel sheet.

Carlisle, C. G., and Co., Ltd., Iona Steel Works, 629 Penistone Rd., Sheffield, 6. T.: Sheffield 348791. Stainless-steel bars.

Clifford, Charles, Ltd., Dogpool Mills, Birmingham, 30. T.: Selly Oak 1544-8. Rolled metal products in tube, rod, non-ferrous bar and wire.

Darwins, Ltd., Fitzwilliam Works, Tinsley, Sheffield, 9. T.: Sheffield 49049. Aircraft steels and machine tools.

Deritend Stamping Co., Ltd., Bridge House, Station Rd., Blackheath, Birmingham. T.: Blackheath 2261-2. Drop forgings and stampings in steel; pressings in non-ferrous alloys.

Doncaster, Daniel, and Sons, Ltd., Birley House, Sheffield, 6. T.: Sheffield 345261. Forgings; turbine blades, etc.

Dudley Drop Forging Co., Ltd., Holly Hall, Dudley, Worcs. T.: Brierley Hill 77561. Forgings in steel, titanium, Nimonic, aluminium, phosphor-bronze.

Equator Wheels and Sections, Ltd., Raglan St., Wolverhampton. T.: Wolverhampton 21605. Stainless-steel stiffening bands. Cold rolling, forming, profiles, etc.

Fry's Metal Foundries, Ltd., Tandem Works, Merton Abbey, London, S.W.19. T.: Mitcham 4023. Solders and fluxes; Fryolux solder paint.

Hadfields, Ltd., East Hecla Works, Tinsley, Sheffield, 9. Alloy and stainless steel; steel castings and forgings; turbine discs and precision cast blading.

Hall and Pickles, Ltd., 64 Port St., Manchester, 1. T.: Central 4571. Stainless and heat-resisting steels; die and carbon cast steels.

Jonas and Colver (Novo), Ltd., Novo Steel Works, Sheffield, 9. T.: Sheffield 41245. Aircraft steels.

Kaye, E. and E., Ltd., Queensway, Ponders End, Enfield, Middx. T.: Howard 1601. Aluminium and alloys in bars, tubes, sections and wire. High conductivity copper wire, strip and strand.

Kayser, Ellison and Co., Ltd., Carlisle Steel Works, Sheffield, 4. T.: Sheffield 22124. High-speed, stainless, heat-resisting and alloy steels.

Kent Alloys, Ltd., Temple Manor Works, Rochester, Kent. T.: Strood 7674-7. Aluminium, magnesium, copper base and iron alloy castings.

Langley Alloys, Ltd., Langley, Slough, Bucks. T.: Langley 432. Hidurel high-conductivity alloys; Hidurax aluminium bronzes; castings in Langalloy stainless steels and nickel base alloys.

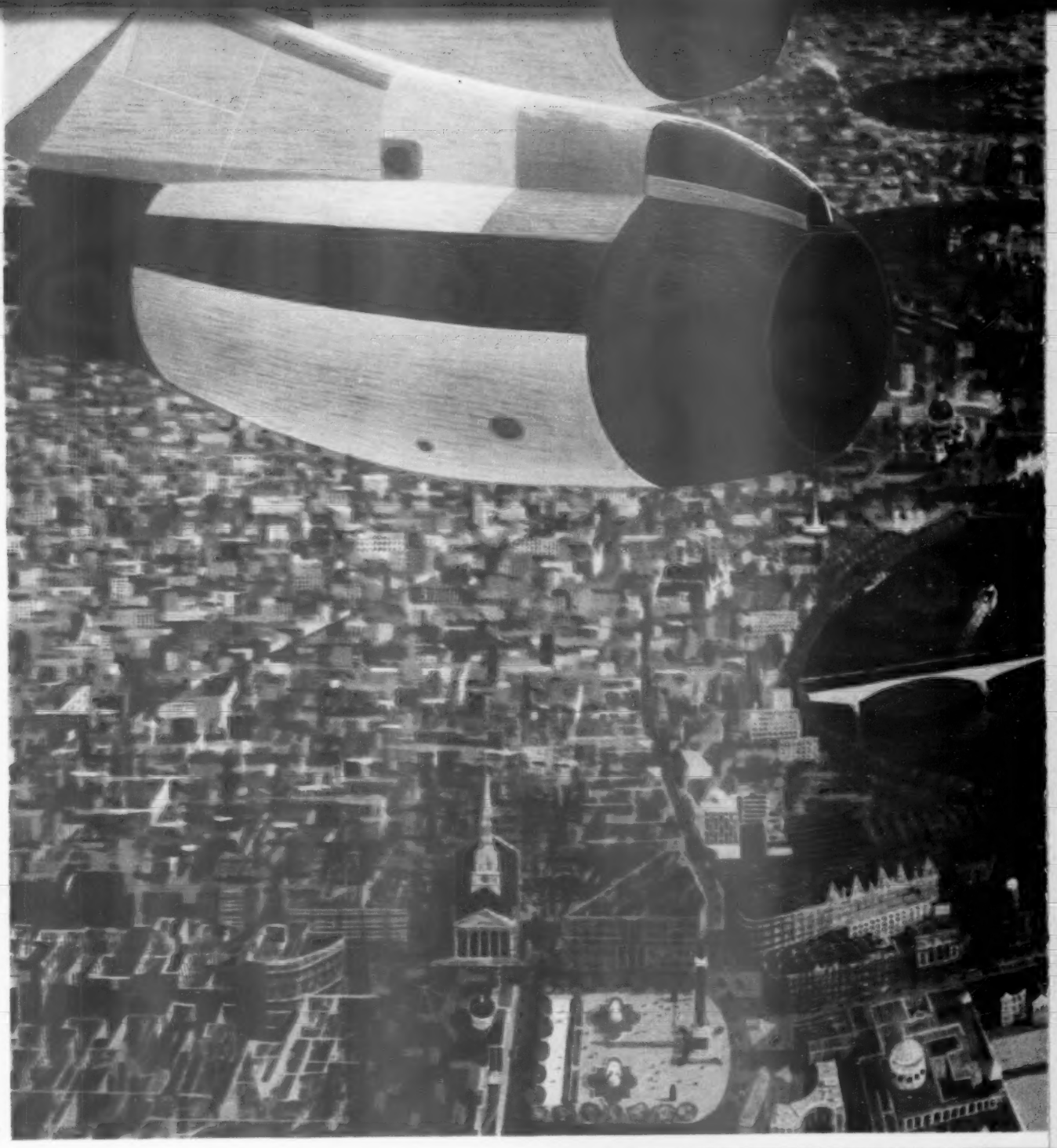
Lavender, J. H., and Co., Ltd., Hall Green Works, Crankhall Lane, West Bromwich. T.: Stone Cross 2273. Aluminium alloy castings.

Lee, Arthur, and Sons, Ltd., Trubrite Steel Works, Meadow Hall, Sheffield. Carbon and alloy steel bars, steel strip, wire, etc.; also stainless steel.

Light-Metal Forgings, Ltd., Churchbridge, Oldbury, nr. Birmingham. T.: Broadwell 1152 and 1895. Drop forgings and stampings.

Low Moor Alloy Steel Works, Ltd., The Steel Works, Low Moor, Bradford, Yorks. T.: Bradford 77331. Stainless, tool, die and alloy steels.

(*Continued on page 235*)



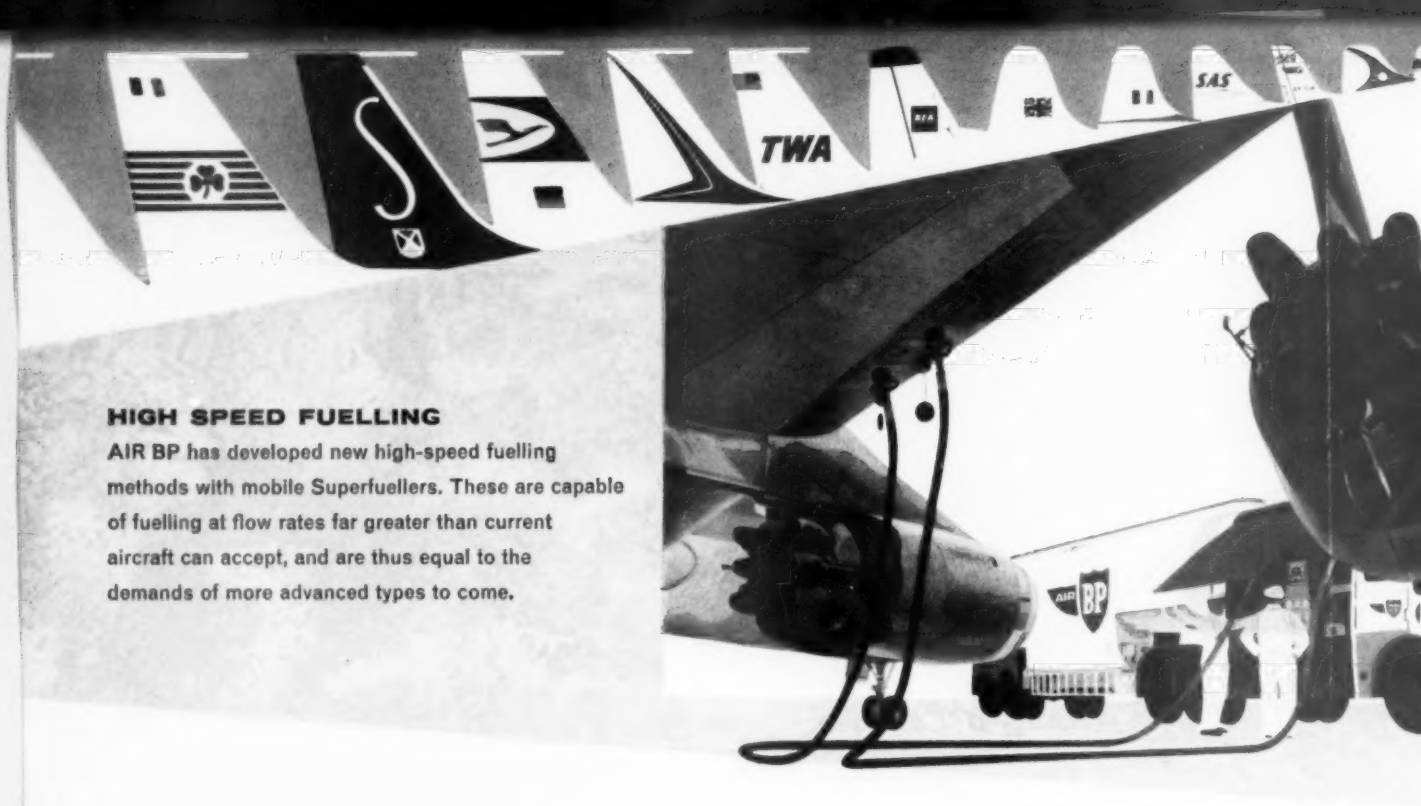
Fast flying airlines . . .

Fast flying airlines . . .

. . . fast fuelling

AIR BP

London bystanders see, overhead, the airliners of most nations as they ply to and from London Airport: among them, most of the airlines fuelled by AIR BP on the world's air routes.



HIGH SPEED FUELLING

AIR BP has developed new high-speed fuelling methods with mobile Superfuellers. These are capable of fuelling at flow rates far greater than current aircraft can accept, and are thus equal to the demands of more advanced types to come.

MOST OF THE WORLD'S INTERNATIONAL AIRLINES ARE FUELLED BY AIR BP

CLEAN FUEL RESEARCH

AIR BP has carried out extensive research into the problems of micronic filtration and water separation at the BP Research Centre for many years.
An important part of the work is the full scale testing of equipment under actual working conditions. AIR BP has developed a special test unit for this purpose and all equipment is rigorously tested before being accepted.

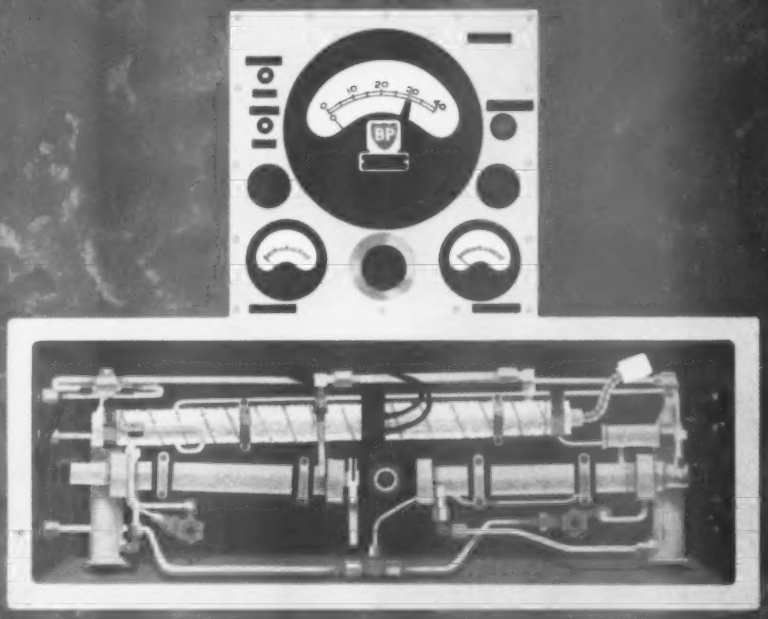
TILLEY·01

AIR BP

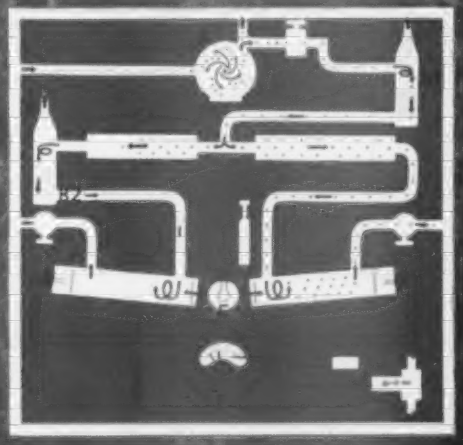
RESEARCH has a beginning, but—in AIR BP—no end. The guiding purpose of this continuous process is to be ready in advance of new requirements, so that whatever the aircraft industry may bring forth, a complete AIR BP service will exist capable of meeting all new demands in fuel specifications and fuelling techniques.

Now AIR BP Clean Fuel Research produces

BP AQUASCAN



This new instrument continuously samples every gallon of fuel during delivery for the presence of undissolved water. This is the first successful device of its kind—simple and compact, ideal for practical airport service. BP AQUASCAN is the latest development in the AIR BP Clean Fuel Research programme and will consolidate the Company's leadership in this vital sphere.



As fuel is delivered, a continuous sample is drawn through a dispenser (A) and air separator (B1).

Part of this sample is then filtered (B2) to remove any suspended water and passed to a cell of the comparator (D1) via a further air separator (B3).

The remainder passes directly into the other cell (D2) through a Balance Cell (C).

Light from a single source (E) is passed through both cells and compared photoelectrically.

Any undissolved water in the consumer sample will cause more light to be absorbed than in the treated sample.

This difference in light absorption is applied on a dial (F) calibrated to parts per million undissolved water in fuel.

When a preset limit is reached, delivery of fuel is immediately cut off.

BP Aquascan continuously samples fuel for undissolved water. Automatically cuts off fuel delivery at any predetermined setting if unacceptable amounts of undissolved water are present. BP Aquascan, now being rolled out to AIR BP airports, is a major technical achievement.

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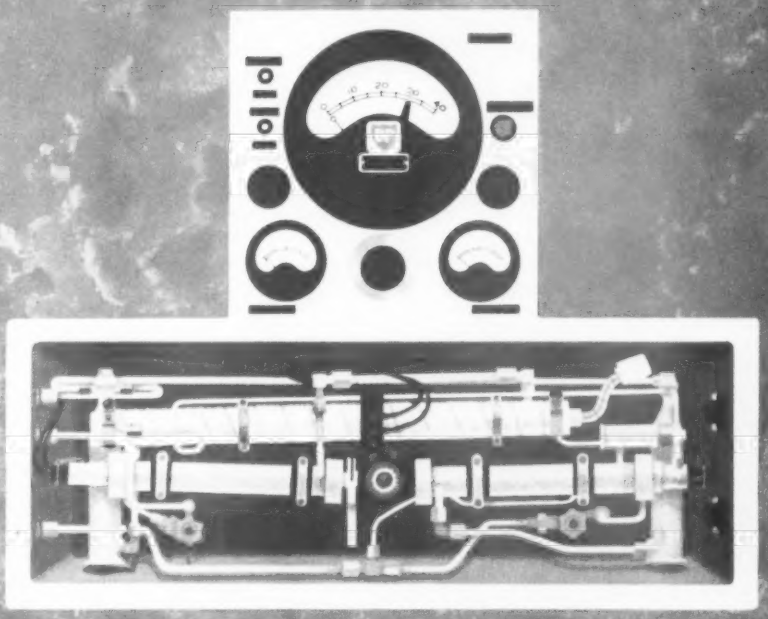

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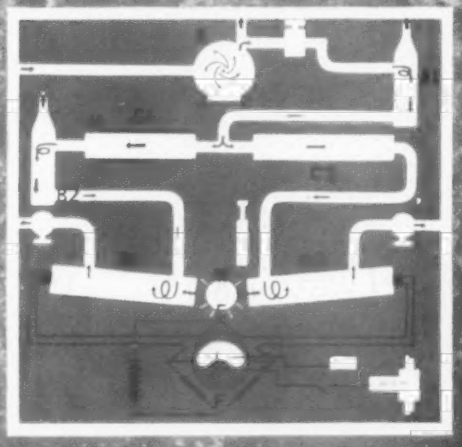


As fuel is delivered, a continuous sample is drawn through a dispenser (A) and air separator (B1).

Half of this sample is then heated (C1) to remove any suspended water and enters one cell of the comparator (D1) via a further air separator (B2).

The remainder passes directly into the other cell (D2) through a Balance Cell (C2).

Light from a single source (E) is passed through both cells and compared photo-electrically.

Any undissolved water in the unheated sample will cause more light to be absorbed than in the heated sample.

This difference in light absorption is measured on a dial (F) calibrated in parts per million undissolved water to fuel.

When a pre-set limit is reached, delivery of fuel is immediately cut off.

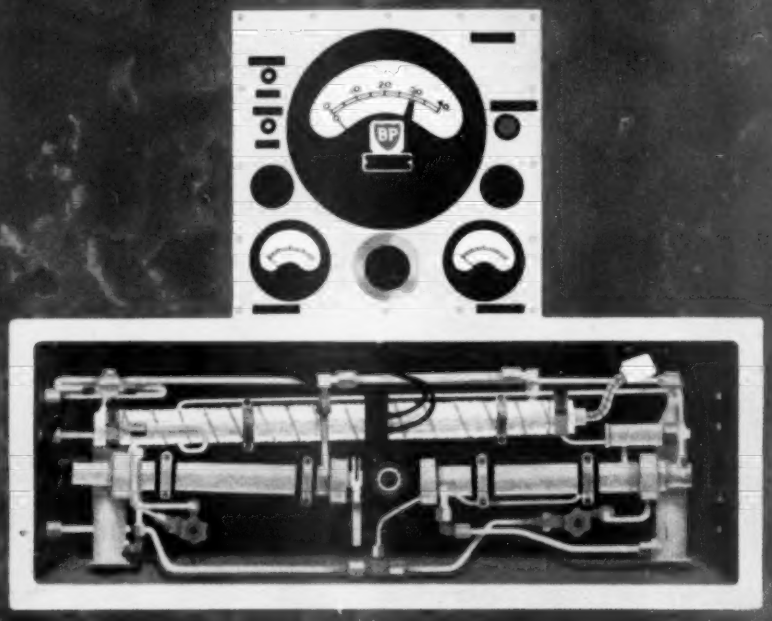
BP Aquascan *continuously* samples fuel for undissolved water: *automatically* cuts off fuel delivery at any predetermined setting if unacceptable amounts of undissolved water are present. BP Aquascan, now being fitted to AIR BP fuellers, is a major technical achievement.

AIR BP

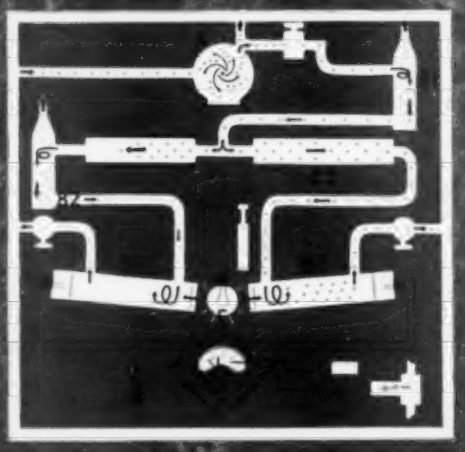
RESEARCH has a beginning, but—in AIR BP—no end. The guiding purpose of this continuous process is to be ready in advance of new requirements, so that whatever the aircraft industry may bring forth, a complete AIR BP service will exist capable of meeting all new demands in fuel specifications and fuelling techniques.

Now AIR BP Clean Fuel Research produces

BP AQUASCAN



This new instrument continuously samples every gallon of fuel during delivery for the presence of undissolved water. This is the first successful device of its kind—simple and compact, ideal for practical airport service. BP AQUASCAN is the latest development in the AIR BP Clean Fuel Research programme and will consolidate the Company's leadership in this vital sphere.



BP Aquascan continuously samples fuel for undissolved water, automatically cuts off fuel delivery at any predetermined setting if unacceptable amounts of undissolved water are present. BP Aquascan, now being fitted to AIR BP fuellers, is a major technical achievement.

AIR BP

Trade Directory . . . .

(Continued from page 284)

Macready's Metal Co., Ltd., Usaspead Corner, Pentonville Rd., London, N.1. T.: Terminus 7060. Bright and alloy steel stockholders.

Manganese Bronze and Brass Co., Ltd., The, 2 London Wall, London, E.C.2. T.: London Wall 8802. Wrought metals and self-lubricating bearings.

Miller, F., and Co. (London), Ltd., Cambridge Ave., Trading Estate, Slough, Bucks. T.: Slough 25511. Engineers' stockists.

Mills, Exors. of James, Ltd., Bredbury Steel Works, Woodley, nr. Stockport. Ledloy free-cutting steel, etc.

Mills, William, Ltd., Friar Park Rd., Wednesbury, Staffs. T.: Stonecross 2651-5. Aluminium and magnesium alloy castings, etc.

Mining and Chemical Products, Ltd., 86 Strand, London, W.C.2. T.: Covent Garden 3393. Cerro fusible alloys.

Morgan, George, Ltd., Grange Rd., Selly Oak, Birmingham, 29. T.: Selly Oak 1156. Drop forgings in alloy, carbon and stainless steels.

Nitralloy, Ltd., Atlas Works, Sheffield, 4. T.: Sheffield 26646. Nitriding process of case-hardening special steels and Nitralloy steels.

Omes, Ltd., Beverley Works, Barnes, London, S.W.13. T.: Prospect 2291. Electrically upset and gas turbine blade forgings.

Perry Barr Metal Co., Ltd., Oscott and Queslett Works, Shady Lane, Gt. Barr, Birmingham, 22a. T.: Gt. Barr 1794. Light alloys.

Rapp, Leo, Ltd. (inc. LR Airsteel, Ltd.), Wimborne Av., Norwood Green, Southall, Middx. T.: Southall 2322. Aircraft aluminium and steel.

Rollet, H., and Co., Ltd., 6 Chesham Place, London, S.W.1. T.: Belgravia 4300. Non-ferrous materials and stainless steels.

Rotherham Forge and Rolling Mills Co., Ltd., Rotherham, Yorks. T.: Rotherham 3281. Rollers, forgers and drop stampers of steel sheets, bars.

Samlesbury Engineering Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Mellor 666. Steel extrusions.

Senior, George, and Sons, Ltd., Ponds Forge, Sheffield, 2. T.: Sheffield 25174. Tool steel manufacturers.

Sheepbridge Alloy Castings, Ltd., Hamilton Rd., Sutton-in-Ashfield, Notts. T.: Sutton-in-Ashfield 323 and 590. Alloy steel and nickel base alloy castings.

Sheffield Forge and Rolling Mills, Ltd., Millsands, Sheffield, 3. Aircraft steels.

Smethwick Drop Forgings, Ltd., Rolfe St., Smethwick. T.: Smethwick 1234. Drop forgings.

Smith-Clayton Forge, Ltd., Tower Works, Lincoln. T.: Lincoln 25492. Forgings and drop stampings.

Stedall and Co., Ltd., 192-204 Pentonville Rd., London, N.1. T.: Terminus 3699. Aluminium sheet, bars and rods.

Steel Stampings, Ltd., Cookley, nr. Kidderminster. T.: Wolverley 266. Pressings in stainless steel and other metals; welded rings.

Talbot Stead Tube Co., Ltd., Green Lane, Walsall, Staffs. T.: Walsall 21222. Stainless and heat-resisting steel tubes, machined parts; manipulated and fabricated tubes; bright-drawn and precision-ground bars, shafting, wire.

Telcon Metals, Ltd., Telcon Works, Manor Royal, Crawley, Sussex. T.: Crawley 28800. Special alloys.

Titanium Metal and Alloys, Ltd., 2 Metal Exchange Buildings, Leadenhall Ave., London, E.C.3. T.: Mansion House 4521; and Clyde Steel Works, Sheffield, 2. Titanium rolled bar, forged blanks, rings and sheets.

United Steel Companies, Ltd., The, P.O. Box 64, The Mount, Broomhill, Sheffield, 10. T.: Sheffield 60081; and 8 Grosvenor Gardens, London, S.W.1. T.: Sloane 4533. Iron and steel plates, sections, forgings; alloy and special steels.

Vaughan Bros. (Drop Forgings), Ltd., Eagle Works, Willenhall, Staffs. T.: Willenhall 436-8. Drop forgings.

Yorkshire Engineering Supplies, Ltd., Upper Wortley Rd., Wortley, Leeds, 12. T.: Leeds 638234 and 638291. Eatonia and E.C.C. castings.

Yorkshire Imperial Metals, Ltd., P.O. Box 166, Leeds. T.: Leeds 72222. Solid-drawn tubes, Yorkshire capillary fittings.

Young, A. S., and Co., Ltd., Tower Works, Woodside Lane, London, N.12. T.: Hillside 6606-7. Welding rods and Colmonoy hard-surfacing alloys, Nicrobraz brazing alloy.

2—Non-metallic Materials

Albright and Wilson (Mfg.), Ltd., Knightsbridge Green, London, S.W.1. T.: Kensington 3422. Chemicals.

Baines, C. O. H., Ltd., 77 Renshaw St., Liverpool, 1. T.: Royal 4961-2. Sponge rubber sections.

British Belting and Asbestos, Ltd., Scandinavia Mills, Cleckheaton, Yorks. T.: Cleckheaton 3222. Mintex brake and clutch linings and other friction materials; Asbestos yarns, cloths, tapes, packings and jointings; Scandura P.V.C. fire-proof conveyor belting.

British Moulded Plastics, Ltd., Avenue Works, Walthamstow Av., London, E.4. T.: Larkswood 2323. Teleduron bitumen asbestos compound and mouldings; moulded plastics and extrusions.

British Replin, Ltd., 2 South Audley St., London, W.1. T.: Grosvenor 6692. Upholstery fabrics.

Bury Felt Manufacturing Co., Ltd., Hudcar Mills, Bury, Lancs. T.: Bury 2262-8. Wool and hair felts, technical felts, mechanical cloths and plastics foam.

Bushing Co., Ltd., The, Hebburn, Co. Durham. T.: Hebburn 83-2241. Synthetic resin, bonded laminated paper and fabric sheets, tubes; machined parts and reinforced mouldings.

B.X. Plastics, Ltd., Brantham, Manningtree, Essex. Cobex, Bexfilm, Velbex, Xylonite, Bextrene sheet and moulding materials. B.X. chemicals.

Cape Asbestos Co., Ltd., 114 Park St., London, W.1. T.: Grosvenor 6022. Insulating materials, linings; building and insulation boards.

Coin Insulation, Ltd., Coin Works, St. John's Rd., Woking, Surrey. T.: Woking 4789-90. Laminated plastics, components and materials.

Cork Manufacturing Co., Ltd., Hall Lane, South Chingford, London, E.4. T.: Silverthorn 1101. Langite and Neolangite jointings and packings.

Daleman, Richard, Ltd., 325-327 Latimer Rd., London, W.10. T.: Ladbroke 7455. Evolite Perspex (acrylic) tubes and cylinders.

Expanded Rubber Co., Ltd., Mitcham Rd., Croydon, Surrey. Onazote expanded acylonitrile foradomes; Rubazote soft expanded rubber.

Ferodo, Ltd., Chapel-en-le-Frith, Stockport. T.: Chapel-en-le-Frith 2520. Friction materials.

Flexo Plywood Industries, Ltd., Hall Lane, South Chingford, London, E.4. T.: Silverthorn 1101. Lightweight sandwich panels; metal-faced Redux-bonded plywood; glass-fibre and other low-pressure plastics laminates.

Gosheron, John, and Co., Ltd., Packaging and Industrial Tape Centre, Kensington Church St., London, W.8. T.: Western 8011. Self-adhesive tapes.

Hall and Hall, Ltd., Oldfield Works, Hampton, Middx. T.: Molesey 2180. Hydraulic packings and jointings; gaskets; synthetic rubber mouldings, sheetings, extrusions and patent fluid seals.

Jones, Samuel, and Co., Ltd., New Bridge St., London, E.C.4. T.: Fleet St. 6500. Self-adhesive tapes.

Kantex, Ltd., Elstree Way, Elstree, Herts. T.: Elstree 1777-9. Neo-K-Tex jointings; anti-vibration and insulation packings.

Klinger, Richard, Ltd., Klingerit Works, Sidcup, Kent. T.: Footscray 7777. Compressed asbestos sheet jointing and gaskets; universal oil-resistant jointing; P.T.F.E. components; silicone rubbers and synthetic rubber.

Leicester, Lovell and Co., Ltd., North Baddesley, Southampton, Hants. T.: Rownhams 2131-8. Synthetic resins and casein glues.

Long and Hambly, Ltd., Slater St., High Wycombe, Bucks. T.: High Wycombe 4041-7. Rubber, synthetic rubber and silicone mouldings, sheetings and extrusions; bonded rubber to metal work; moulded lead assemblies and plastics mouldings.

Mandleberg, J., and Co., Ltd., Albion Works, Cobden St., Pendleton, Salford 6, Lancs. T.: Pendleton 1441. Proofed fabrics for balloons, dinghies, flotation gear, inflatable chairs, aircraft covers, etc.

Minnesota Mining and Manufacturing Co., Ltd., 3M House, Wigmore St., London, W.1. Hunter 5522. Scotch Boy cellulose and masking tapes, 3M adhesive coatings and sealers; 3M coated abrasives.

Morgan Crucible Co., Ltd., The, Battersea Church Rd., Battersea, London, S.W.11. T.: Battersea 8822. Morganite carbon and metal-graphite brushes and contacts. Carbon piles and electrodes.

Moulded Components (Jablo), Ltd., Mill Lane, Croydon, Surrey. T.: Croydon 2201. Airscrew and helicopter blades, etc. Sandwich panels with Aero Jablex core; glass-fabric facings; thermal and sound insulation.

Nobrac-Carbon, Ltd. Commerce Way, Lancing, Sussex. T.: Lancing 2951-4. Specialist grade carbons.

North British Plastics, Ltd., Patterson St., Blaydon-on-Tyne. T.: Blaydon 346-9. Panax paper-base laminated sheets, etc.

Peradin Rubber Co., Ltd., Freshford, nr. Bath, Somerset. T.: Limpley Stoke 3263. Peratol sealing compound.

Plastikade (Manchester), Ltd., Central Mill, Woodstock St., Oldham, Lancs. T.: Oldham (Main) 8261-3. Polyurethane foams for thermal and sound insulation and upholstery.

Rubbaglas, Ltd., Abford House, 15 Wilton Rd., London, S.W.1. T.: Victoria 6501. Rubbaglex sheeting. Silastic rubber mouldings, processed glass.

Scott, Bader and Co., Ltd., Wollaston, Wellingborough, Northants. T.: Wollaston 262. Marco and Crystic polyester resins.

Smith and Nephew, Ltd., Bessemer Rd., Welwyn Garden City, Herts. T.: Welwyn Garden City 5151. Lasso self-adhesive tapes.

Sorbo, Ltd., Woking, Surrey. T.: Woking 966. Rubber goods.

Surridge's Patents, Ltd., New Works, Croydon Rd., Elmers End, Beckenham, Kent. T.: Beckenham 0168. Holdtite adhesives.

Thermo-Plastics, Ltd., Luton Road Works, Dunstable, Beds. T.: Dunstable 64255. Plastics components from Perspex, P.V.C. resin bonded glass-fibre, etc.

Tinkertex, Ltd., Bottoms Mill, Holmfirth, nr. Huddersfield. T.: Holmfirth 636. Aircraft upholstery cloth and curtaining. Uniform cloths.

Tufnol, Ltd., Perry Barr, Birmingham, 22B. T.: Birchfields 4554. Laminated plastics for aircraft components.

Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs. T.: Rochdale 4221. Resinated asbestos felts, flocks and powder; glass fabrics, tapes, rovings, yarns and chopped-strand mats.

Vane, A. H., and Co., Ltd., Iando House, Bartholomew Close, London, E.C.1. T.: Metropolitan 2201-2. Linen, cotton and neoprene fabrics, serrated tapes, flax thread, etc.

Wallington, Weston and Co., Ltd., Vallis Mills, Frome, Somerset. T.: Frome 3271-6. Flexible P.V.C. sheet, high-impact rigid thermoplastic sheet.

Warerite, Ltd. (unit of Bakelite, Ltd.), Watton Rd., Ware, Herts. Decorative laminated plastics.

Woods, Sons and Co. (Fibres), Ltd., Clerkenwell House, Clerkenwell Green, London, E.C.1. T.: Clerkenwell 6714-7. Fabrics, tapes, cordage, wire cable, etc.

Wright, John, and Sons (Veneers), Ltd., Avon Wharf, Longfellow Rd., Mile End Rd., London, E.3. T.: Advance 4444. British-cut veneers for construction and decoration.

3—Prefabricated Components and Parts

Abbey Panel and Sheet Metal Co., Ltd., Bayton Rd., Exhall, nr. Coventry. T.: Bedworth 2071. Aircraft fabrications, cowls and assemblies.

AC-Delco (Division of General Motors, Ltd.), Dunstable, Beds. T.: Dunstable 64264. Sparking plugs; oil filters; air cleaners; fuel pumps; instruments; thermostats; ignition and starting equipment; electric motors.

Aerocontacts, Ltd., Gatwick House, Horley, Surrey. T.: Horley 4455. A.G.S. parts, accessories and components.

Aerolex, Ltd., Bridge Rd., Camberley, Surrey. T.: Camberley 1500. Components and assemblies.

Aeroparts Engineering Co., Ltd., Commercial Rd., Hereford. T.: Hereford 3068. Assemblies and components; lubrication equipment.

Aircraft Engineering and Jigs, Ltd., Hargreaves Works, Oldham, Lancs. T.: Main 3818-9. Components.

Aircraft-Marine Products (Gt. Britain), Ltd., Amplo House, 87-89 Saffron Hill, London, E.C.1. T.: Chancery 2902-8. Solderless terminals and connectors.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfields 4571. Flame traps, fuel filters, precision components and assemblies.

Angus, George, and Co., Ltd., Angus House, 148-158 Westgate Rd., Newcastle upon Tyne, 1. T.: Newcastle upon Tyne 22656-9. Oil seals, hydraulic packings and mouldings, brake and clutch linings, gears, fire extinguishers, fire hose, transmission and conveyor belting.

Areas Controls, Ltd., Trowers Way, Holmethorpe, Redhill, Surrey. T.: Redhill 5511-3. Remote controlling gear; operating boxes; end fittings.

Trade Directory . . . .

Armstrong Patents Co., Ltd., Eastgate, Beverley, Yorks. Heli-coil screw thread inserts and high-endurance nuts.

Aston, E. S., and Co., Ltd., 5 Sebastian St., Goswell Rd., London, E.C.1. T.: Clerkenwell 2179. Instrument panel cleats; fairleads; packings and control knobs in laminated plastics and cast resins.

Autoset (Production), Ltd., 76 Stour St., Birmingham, 18. T.: Edgbaston 1143. Springs and rubber-suspension equalizing castors; fixed-direction wheel brackets; castors.

Avery Equipment, Ltd., Tachbrook Rd., Leamington Spa. T.: Leamington Spa 2700. Flexible hose and self-sealing couplings.

Aviation Traders (Engineering), Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791. Sub-contractors of aircraft components.

Barber and Colman, Ltd., Marsland Rd., Brooklands, Manchester. T.: Sale 2277. Shakeproof thread-cutting screws; lock washers.

Baxter's (Bolts, Screws and Rivets), Ltd., Parade Works, Sheepcote St., Birmingham, 15. T.: Midland 0105. Bolts and rivets.

B.M.B. (Sales), Ltd., High St., Crawley, Sussex. Steel bearings and balls. Miniature bearings.

Borg and Beck Co., Ltd., Tachbrook Rd., Leamington Spa. T.: Leamington Spa 2700. Clutches.

Bowden (Engineers), Ltd., Victoria Rd., Willesden Junction, London, N.W.10. T.: Elgar 4805-9. Synthetic rubber hose units and flexible metallic tube; wire mechanism-control assemblies for cables; precision ball bearing mechanisms; component machining.

Brake Linings, Ltd., Bridge St., Buxton, Derbyshire. T.: Buxton 2851. Brake and clutch linings and allied friction components; supercharger discs.

Bramah, J. R., and Co., Ltd., Devonshire St., Sheffield, 3. T.: Sheffield 24228. Aircraft tanks, aluminium alloy, Nimonic, titanium, stainless steel fabrications.

Brauer, F., Ltd., Grove Road, Harpenden, Herts. T.: Harpenden 3603. Toggle clamps.

British Timken (Division of the Timken Roller Bearing Co.), Duston, Northampton. T.: Northampton 4921-8 and 3452-3. Tapered roller bearings.

British Tyre and Rubber Co., Ltd., Hertsa House, Vincent Sq., London, S.W.1. T.: Victoria 3848. Rubber de-icing, seals, etc.

British Wire Products, Ltd., Worcester Rd., Stourport-on-Severn, Worcs. T.: Stourport 2551. Control cables; Britloc wire rope slings; oil filters, pipe-bending, etc.

Brooks, T. J. (Leicester), Ltd., Beech St., Leicester. T.: Leicester 27987. Aircraft components.

Brown, E. G., and Co., Ltd., West Rd., Northumberland Park, Tottenham, London, N.17. T.: Tottenham 2257. Fuel and oil tanks, pilots' seats, tailplane assemblies and elevators, cowlings, pressings, stampings.

Burnley Aircraft Products, Ltd., Fulledge Works, Holmes St., Burnley. T.: Burnley 7681. Wing flaps, bomb doors and hatches, jettison tanks. Sheet metal and steel components.

C.W.C. Equipment, Ltd., Kings Grove, Maidenhead, Berks. T.: Maidenhead 2275-7. Toggle switches and connectors; fluorescent lighting; fittings; relays; plugs; sockets; connectors and terminations.

Carr Fastener Co., Ltd., Stapleford, Nottingham. T.: Sandiacre 2661. Fasteners.

Cathodeon, Ltd., Church St., Cambridge. T.: Cambridge 56481. Hermetic glass-to-metal seals. Vacuum tubes and high-voltage vacuum relays.

Centrax, Ltd., Sheldon Rd., Newton Abbott, Devon. T.: Newton Abbott 2251. Machined compressor and turbine blades; sheet metal fabrication; gears and gearboxes.

Clarke, Chapman and Co., Ltd., Moorlands Avenue, Kenilworth, Warwicks. T.: Kenilworth 535-6. Aero-engine components and airframe sub-assemblies.

Clayton-Wright, Howard, Ltd., Wellesbourne, Warwickshire. T.: Wellesbourne 316-8. Self-sealing weatherstrip; Nylastic adjustable cable and Clatomrite anti-vibro cable support clips; Harrisflex anti-vibration mountings; Clayflex flexible-bearings; Nylastic bearings; Clatonrite Stikastrip.

Corfield and Buckle, Ltd., Trafalgar Works, Merton, London, S.W.19. T.: Liberty 1144-9. Deep stampings and press work; assemblies.

Corner, G., and Co., Ltd., Pennant St., Oldham. T.: Main 9205. Sheet metal assemblies.

Coventry Climax Engines, Ltd., Widdrington Rd. Works, Coventry. T.: Coventry 28481. Accessories.

Cramic Aircraft Components, Ltd., Bridge Road, Southall, Middx. T.: Southall 3411. Components in aluminium alloys and non-ferrous metals.

Crane Packing, Ltd., Slough, Bucks. T.: Slough 24031. Gland packings and mechanical seals. Processors and fabricators of P.T.F.E.

Cross Manufacturing Co. (1938), Ltd., 33 Midford Rd., Combe Down, Bath. T.: Combe Down 2355. Spring washers, labyrinth seals, wire-thread inserts, springs, etc.

Curd Components, Ltd., 9 Brownfields, Welwyn Garden City, Herts. T.: Welwyn Garden 5471-2. Standard aircraft parts.

Davis and Timmins (Aircraft), Ltd., Billet Rd., Walthamstow, London, E.17. T.: Larkswood 2313. A.G.S., B.S.S. and A.S. parts.

Day, J., and Co. (Derby Works), Ltd., Harrow Manor Way, Abbey Wood, London, S.E.2. T.: Woolwich 7036-8. Cable and wire.

Doncaster, Daniel, and Sons, Ltd., Birley House, Sheffield, 6. T.: Sheffield 345261. Drop forgings; valve forgings; and finished machined precision forged compressor and turbine blades.

Drallim Industries, Ltd., Station Works, Westhall Rd., Upper Warlingham, Surrey. T.: Upper Warlingham 2873. Control and multi-way selector valves; flow gauges; A.G.S. pipe fittings.

Equator Wheels and Sections, Ltd., Raglan St., Wolverhampton. T.: Wolverhampton 21605-6. Stainless steel stiffening bands for jet engines; cold rolling, forming and coiling in all metals; profile manipulations.

Fafnir Bearing Co., Ltd., Upper Villiers St., Wolverhampton. T.: Wolverhampton 26101. Ball and parallel roller bearings and transmission equipment.

Filton, Ltd., Wharf Works, Clapham St., Leamington Spa, Warwicks. T.: Leamington Spa 8111-2. Impeller pumps; rotary ball-bearing unions; rotary pipe couplings; crankcase breathers and filters.

Fletcher, C. W., and Sons, Ltd., Sterling Works, Arundel St., Sheffield, 1. T.: Sheffield 28049 and 28040. Precision sheet-metal work.

Flexello Castors and Wheels, Ltd., Trading Estate, Slough, Bucks. T.: Slough 24121. Wheels, castors and bearings.

Flexibox, Ltd., Nash Rd., Trafford Park, Manchester, 17. T.: Trafford Park 1477. Mechanical seals. Precision lapping machines.

Fox, C. J., and Sons, Ltd., 117 Victoria St., London, S.W.1. T.: Victoria 0204 and 5735. Kaylock self-locking nuts and fasteners.

Glacier Metal Co., Ltd., Alperton, Wembley, Middx. T.: Perivale 6611. Plain bearings and bushes; dry bearing materials; bronzes and white metals; centrifugal oil filters.

Greaves, Arthur (Lees), Ltd., High St., Lees, near Oldham, Lancs. T.: Main 4759. Fuel, oil and hydraulic tanks; engine cowlings; exhaust manifolds and pipes.

Hall and Hall, Ltd., Oldfield Works, Hampton, Middx. T.: Molesey 2180. Hydraulic packings and jointings; gaskets; synthetic rubber mouldings, sheetings, extrusions and oilseals.

Hardy Spicer, Ltd., Chester Rd., Erdington, Birmingham, 24. T.: Erdington 2191. Universal joints and cardan shafts.

Harper, C. E., Aircraft Co., Ltd., Exeter Airport, Clyst Honiton, Devon. T.: Exeter 67451. Components and sub-assemblies.

Henderson Safety Tank Co., Ltd., The, 2 Elstree Way, Boreham Wood, Herts. T.: Elstree 1758. Sheet metal work; machining, tools and fixtures.

Hercules Engineering Co., Ltd., The, Worton Rd., Isleworth, Middx. T.: Isleworth 7312-4. Aircraft engineers; copper and glass fibre specialists.

Heston Aircraft and Associated Engineers, Ltd., Heston Airport, Hounslow, Middx. T.: Hayes 3844-52. Sub-assemblies and components.

Hickman, Ltd., North Circular Rd., London, N.W.2. T.: Gladstone 6262. Passenger tables and meal tray containers; split seam tubing; distance pieces and stainless steel fabrications.

Hobourn Aero Components, Ltd., Strood, Rochester, Kent. T.: Strood 7626. Machined components.

Hoffmann Manufacturing Co., Ltd., The, New St., Chelmsford, Essex. T.: Chelmsford 3151. Ball and roller bearings.

Inferation, Ltd., Stanhope Rd., Camberley, Surrey. Galley equipment and floor warming mats.

Jack, E. J., Ltd., Marlborough Works, Harmood St., London, N.W.1. T.: Gulliver 5761. Ball and roller bearings.

Lawrence, J. W., Ltd., Abbey Lane, Leicester. T.: Leicester 62441. Radiators, oil coolers and heat exchangers.

Laycock Engineering, Ltd., Victoria Works, Millhouses, Sheffield, 8. T.: Sheffield 364411. Sheet metal work; flexible couplings and transmission shafts.

Lentern (Aircraft), Ltd., Main Rd., Hawkwell, Hockley, Essex. Repetition parts.

Linacy, C., and Co., Ltd., Englefield Rd., London, N.1. T.: Clissold 0643-8. Bolts, nuts; repetition parts.

Linread, Ltd., P.O. Box 21, Cox St., Birmingham, 3. T.: Central 3951. Fasteners, bolts, screws and rivets. Special cold-forged products.

Mechanism, Ltd., Gyro Works, George St., Croydon, Surrey. T.: Croydon 3426-9. Aeronautical and precision engineers; aeronautical instruments.

Metalastik, Ltd., Evington Valley Rd., Leicester. T.: Leicester 37281. Rubber-to-metal weld anti-vibration devices; engine-mounting systems; mountings; couplings.

Middleton Sheet Metal Co., Ltd., Spring Vale Works, Middleton, Manchester. T.: Middleton 2427-8. Resistance welding, aircraft control surfaces, access doors, etc. Jet-engine canware; tanks and containers; glass-fibre plastic moulding.

Midland Aeroquipment, Ltd., Park Rd., Bloxwich, nr. Walsall, Staffs. T.: Bloxwich 76414. Aircraft locks and fastenings.

Miller Aviation, Ltd., Adastral House, Nutfield, Surrey. T.: Redhill 5050. B.S.S., S.B.A.C. and A.G.S. parts stockists and distributors.

Moore's (Wallisdown), Ltd., Wallisdown Rd., Bournemouth. T.: Winton 5810. High-precision machining; prototype and assembly work; aircraft fabrications.

Mountford, Fredk. (Birmingham), Ltd., Fremo Works, Moseley St., Birmingham, 5. T.: Midland 7984. A.G.S. parts; pins, bolts, screws and nuts in stainless steel.

Nettlefold and Moser, Ltd., 170-194 Borough High St., London, S.E.1. T.: Hop 7111. Distributors of A.G.S. screws, nuts, etc.; electric and hand tools; transmission equipment.

Newton, L. H., and Co., Ltd., Nechells, Birmingham, 7. T.: East 1551. Special precision components. Bolts, nuts, screws, rivets and washers. Capstan and automatic work. Light pressings; cold forged special work in all metals.

Nobrac-Carbon, Ltd., Commerce Way, Lancing, Sussex. T.: Lancing 2951-4. Carbon brush seals; high-altitude brushes.

Northey Rotary Compressors, Ltd., Alder Rd., Parkstone, Dorset. T.: Parkstone 4900-1. Exhausters for high-altitude instrument testing. Oil-free compressors. Gas boosters for experimental process plant.

Oddie Fasteners, Ltd., Portswood Rd., Southampton. T.: Southampton 55883. Oddie fasteners, quick-release pins.

Opperman, S. E., Ltd., Stuart Works, Stirling Corner, Boreham Wood, Herts. T.: Elstree 2021. Aircraft components, gears and gearing; motor units and materials.

Parkes, L. B., and Co., 16 Station St., Walsall. T.: Walsall 4546. Anodising and metal finishing; pressings and stampings. Crash- and fire-proofing petrol and oil tanks.

Peradin Rubber Co., Ltd., Freshford, nr. Bath, Somerset. T.: Limpley Stoke 3263. Rubber manufacturers specializing in rubber-to-metal bonded parts.

Power Flexible Tubing Co., Ltd., The, Derby Works, Vale Rd., London, N.4. T.: Stamford Hill 6696. Flexible metal bellows, tubing, etc.

Pressed Steel Co., Ltd., Cowley, Oxford. T.: Oxford 77701. Sheet metal work; airframe components and assemblies.

Randall, James H., and Son, Ltd., Paddington Green Works, London, W.2. T.: Ambassador 1661. Sheet metal work. Spinnings.

Ransome and Marles Bearing Co., Ltd., Newark-on-Trent. T.: Newark 5123-38. Bearings.

Renold Chains Ltd., Renold House, Wythenshawe, Manchester. T.: Mercury 5221. Precision chains.

Riley, Robert, Ltd., Milkstone Spring Works, Rochdale. T.: Rochdale 2237. Aircraft springs. Specialists in beryllium copper springs.

Robinson, I., and Co. (Gillingham), Ltd., London Chambers, Gillingham, Kent. T.: Gillingham 51182. Jubilee clips.

Rollason Aerocessories, Ltd., Croydon Airport, Surrey. T.: Croydon 7238-9. Cargo securing devices; servicing and testing equipment; special purpose valves; accessories, components, sub-assemblies, etc.

Rose Bros. (Gainsborough), Ltd., Albion Works, Gainsborough, Lincs. Spherical gearing rod ends.

Salisbury Precision Engineering, Ltd., Heston Airport, Hounslow, Middx. T.: Hayes 3844. Airframe sections, ground equipment, optical inspection projectors.

Salter, Geo. and Co., Ltd., High St., West Bromwich. T.: West Bromwich 1855. Springs, roller bearings, circlips, retaining rings, fasteners, Grey-iron castings.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Mellor 666. Major aircraft components; jigs, tools and fixtures; precision machinists.

Sheepbridge Alloy Castings, Ltd., Hamilton Rd., Sutton-in-Ashfield, Notts. T.: Sutton-in-Ashfield 323 and 590. Bi-metal brake drums.

Siegrist Orel, Ltd., 29-30 Windmill St., London, W.1. T.: Museum 9484-6. Neoprene, silicone and p.v.c. sleeves and cable markers.

Silentbloc, Ltd., Manor Royal, Crawley, Sussex. T.: Crawley 2100. Flexible bearings; anti-vibration mountings and flexible couplings; bonded and moulded rubber components; panel fasteners; riveting pins; mechanical couplings.

Simplifix Couplings, Ltd., Beacon Works, Hargrave Rd., Maidenhead, Berks. T.: Maidenhead 5100. Joints for copper, steel and light alloy tubes.

Skefko Ball Bearing Co., Ltd., The, Luton, Beds. T.: Luton 5700. Ball, cylindrical, taper and spherical roller bearings; pulleys and rollers.

Standard Insulator Co., Ltd., The, Standard Works, Bridge Rd., Camberley, Surrey. T.: Camberley 1813. India rubber grommets and other small mouldings; double turn hose clips.

Stewart Aeronautical Supply Co., Ltd., Adastral House, Nutfield, Redhill, Surrey. T.: Redhill 5050. Aeronautical equipment, spares.

Stream-Line Filters, Ltd., Henley Pk., Normandy, nr. Guildford, Surrey. T.: Normandy 3311-3. Filters for aviation fuels; water separators.

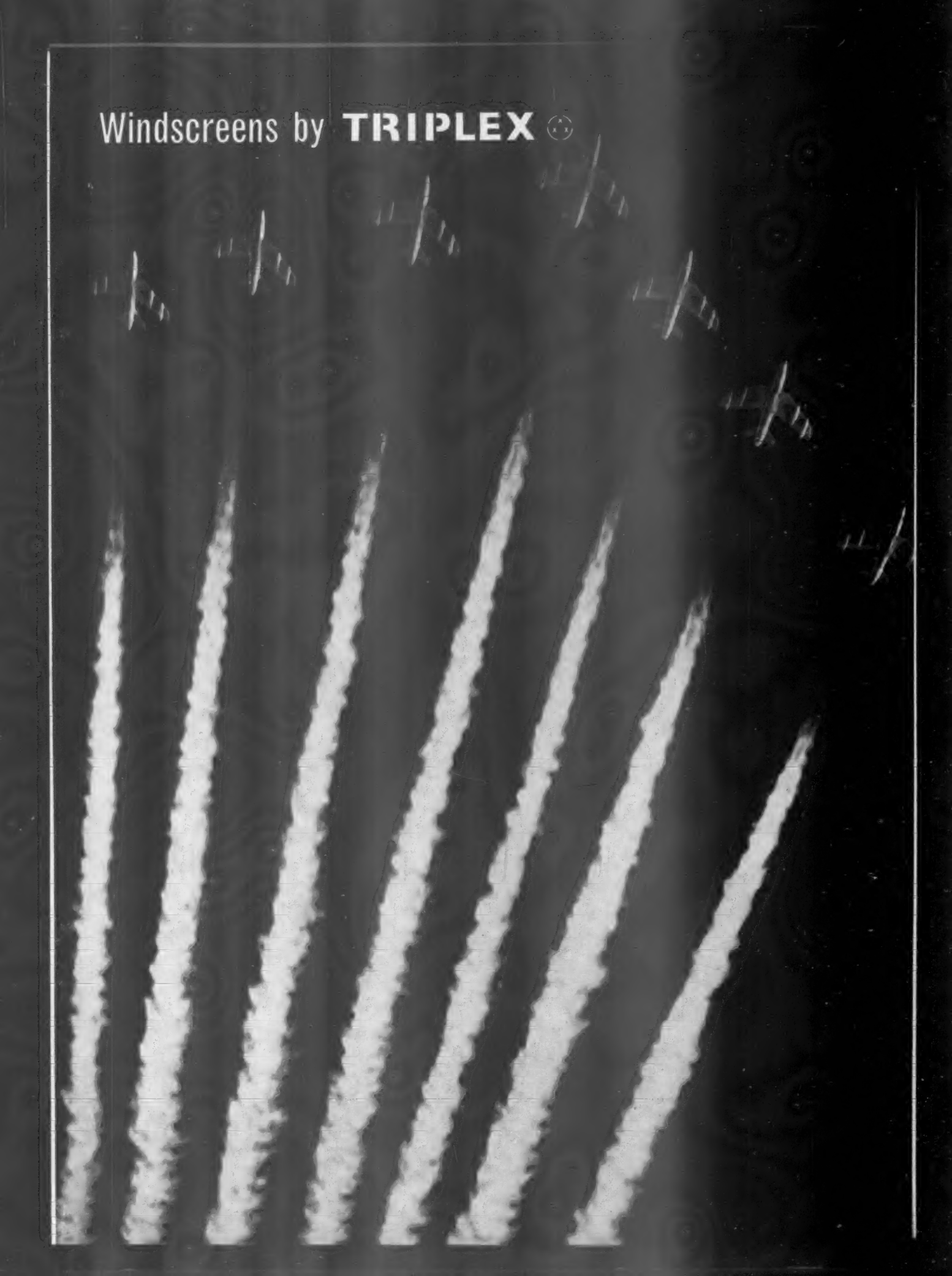
Superflexit, Ltd. 118 Buckingham Av., Slough, Bucks. T.: Slough 24561. Non-metallic flexible tubing.

Taylor, C. F. (Metal Workers), Ltd., Molly Millars Lane, Wokingham, Berks. T.: Wokingham 1005-6. Aircraft fuel tanks, de-icing and pressure ducting, galley equipment, toilets, steps; metalwork, tubular fabrications, glass laminate structures.

Tempered Spring Co., Ltd., The, Warren St., Sheffield, 4, Yorks. T.: Sheffield 21333. Springs.

Tenaplas, Ltd., Upper Basildon, nr. Pangbourne, Berks. T.: Upper Basildon 333-6. Extrusions and fabrications in polythene, p.v.c., nylon; drape and vacuum forming.

(*Continued on page* 287)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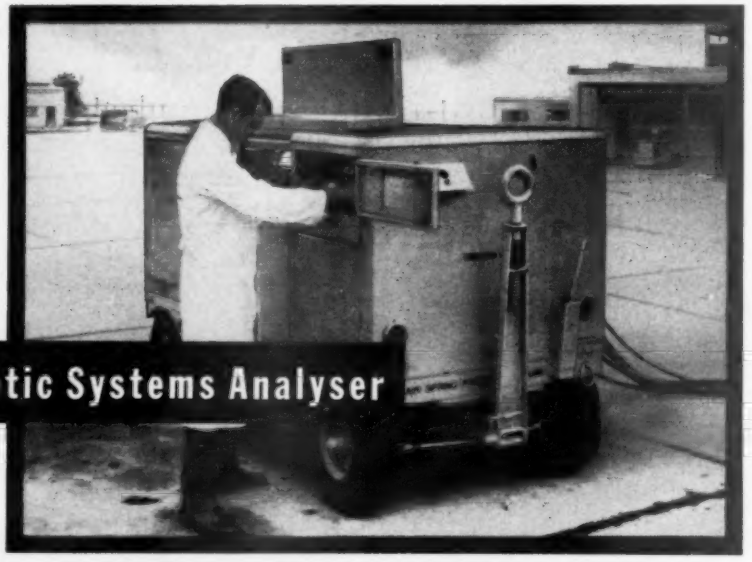

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Trade Directory . . . .

(*Continued from page 286*)

Terry, Herbert, and Sons, Ltd., Redditch, Worcs. T.: Redditch 4261. Springs, presswork, wirework, hose clips, Anglepoise lamps, etc.

Thermo-Plastics, Ltd., Luton Rd. Works, Dunstable, Beds. T.: Dunstable 64255. Canopies; windows; radomes; resin-bonded fibreglass and asbestos de-icing and cabin heating ducting.

Thompson Bros. (Bilston), Ltd., Bradley Engineering Works, Bilston, Staffs. Fabricated metal components; jet engine sheet metal work.

Torrington Co., Ltd., The, Torrington Av., Coventry. T.: Coventry 74241-6. Needle, roller and thrust bearings.

Turner and Savage, Ltd., 140 Willesden Lane, London, N.W.6. T.: Maida Vale 4881. Panel beaters and sheet-metal specialists.

United Flexible Metallic Tubing Co., Ltd., The, South St., Enfield, Middx. T.: Howard 1881-4. Flexible metallic tubing; screened conduit; cabin heater tubes.

Vandervell Products, Ltd., Western Av., London, W.3. T.: Acorn 2251. Thin-wall precision-finished crankshaft main and connecting-rod big-end bearings; thin-wall bushings and thrust washers.

Vandyke Engineering, Ltd., The Pinnacles, Harlow, Essex. T.: Harlow 24652. Sheet metal work; electronic assemblies.

Vokes, Ltd., Henley Park, Guildford, Surrey. T.: Guildford 62861. Air, oil and fuel filters; silencing equipment; cabin air conditioning equipment; flame dampers.

Walker, James, and Co., Ltd., Lion Works, Woking, Surrey. T.: Woking 2432. Synthetic rubber-bonded seals.

Weathershields, Ltd., 147-169 Bishop St., Birmingham, 5. T.: Midland 5876. Seats, upholstery, hoodings; sheet metal fabrications.

Welsh Metal Industries, Ltd., Caerphilly, Glamorgan. T.: Caerphilly 2282. Galvanized holloware; oil storage tanks; machine tool engineers.

Weston, Charles, and Co., Ltd., Irwell Bank Works, Douglas Green, Pendleton, Salford, 6. T.: Pendleton 2857-9. Oil seals and oil-sealing.

Weyburn Engineering Co., Ltd., Elstead, Godalming, Surrey. T.: Elstead 2141. Precision engineers. Camshafts, governors, pumps, etc.

Wilkinson Rubber Linatex, Ltd., Camberley, Surrey. T.: Camberley 1595. Flexatex hose; self-sealing tank coverings; Linatex seals.

4——Tools and Workshop Equipment

Abingdon King Dick, Ltd., Tyseley, Birmingham, 11. Hand tools for repair and maintenance.

Acratork Engineering Co., Ltd., Corys' Buildings, Cardiff. Torque spanners and torque spanner test and setting rigs; hydraulic torque generators.

Adcola Products, Ltd., Adcola House, Gauden Rd., London, S.W.4. T.: Macaulay 4272. Soldering instruments and equipment; solder jointing for radio and radar.

AEI-Birlec, Ltd., Tyburn Rd., Erdington, Birmingham, 24. T.: East 1544. Electric and gas furnaces; absorption dryers; compressed-air systems; gas generators.

Aerocontacts (Ground Equipment), Ltd., Gatwick House, Horley, Surrey. T.: Horley 4455. Aircraft ground equipment and workshop equipment.

Aerograph Co., Ltd., The, 47 Holborn Viaduct, London, E.C.1. T.: City 4361. Spray-painting equipment.

Aerolex, Ltd., Camberley, Surrey. T.: Camberley 1500. Assemblies and tools.

Air Industrial Developments, Ltd., Aidspray Works, Shenstone, nr. Lichfield, Staffs. T.: Shenstone 341-5. Spray-painting and compressed-air equipment.

Allied Electronics, Ltd., 28 Upper Richmond Rd., Putney, London, S.W.15. T.: Vandyke 1856. Simmonds Pacitor fuel-gauge test console.

Alltools, Ltd., 2 Transport Ave., Great West Rd., Brentford, Middx. T.: Isleworth 2100. Precision and aeronautical engineers.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfields 4571. Jet-calibrating machines; Bunsen burners and injectors.

Archdale, James, and Co., Ltd., Blackpole Works, Worcester. Milling and drilling machines.

Asquith, Wm., Ltd., Halifax House, Strand, London, W.C.2. T.: Trafalgar 7224. Drilling and boring machines.

Atkin, W. T., (Tottenham), Ltd., 178 St. Ann's Rd., Tottenham, London, N.15. T.: Stamford Hill 6586. Press toolmakers and metal stampers.

Autoset (Production), Ltd., 76 Stour St., Birmingham, 18. T.: Edgbaston 1143. Castors, drawer slides, engineers' clamps, bearings, trucks, trolleys and transporters.

Aviation Traders (Engineering), Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491. Engine stands and test-bed installations, jigs and fixtures.

Balfour, Arthur, and Co., Ltd., Capital Steel Works, Sheffield, 3. Tel.: Sheffield 22071. Small tools.

Bardolph, J. F., and Partners, Ltd., 1 Robert St., Adelphi, London, W.C.2. T.: Trafalgar 1927. Myers riveting clamps.

Benton and Stone, Ltd., Enots Works, Aston Brook St., Birmingham, 6. T.: Aston Cross 1905. Centralized lubricating systems; machine-tool coolant fittings, etc.

Berk, F. W., and Co., Ltd. (Coating Division), Brent Cres., North Circular Rd., N.W.10. T.: Elgar 3533. Shot-blasting; metal and plastic spraying and supply of associated equipment.

Black and Decker, Ltd., Harmondsworth, Middx. T.: Skyport 2411-9. Portable electric tools; screwdrivers; sanders, polishers and drills.

Britool, Ltd., Britool Works, Bushbury, Wolverhampton. T.: Wolverhampton 31281. Ratchet and fixed-socket spanners; ring, open-jaw and torque wrenches.

Brooke Tool Manufacturing Co., Ltd., The, Warwick Rd., Greet, Birmingham, 11. T.: Victoria 2323. Engineers' small tools in high-speed steel and carbide tipped.

Broom and Wade, Ltd., High Wycombe, Bucks. T.: High Wycombe 1639. Air compressors and pneumatic tools.

B.S.A. Tools, Ltd., (Sole Agents, Burton, Griffiths and Co., Ltd.), Kitts Green, Birmingham, 33. T.: Stechford 4071 (machine tools); Victoria 2351 (small tools). Screw and bar, chucking, grinding and thread-rolling machines; multi-tool lathes.

Burnley Aircraft Products, Ltd., Fulledge Works, Burnley, Lancs. T.: Burnley 7681. Jigs and tools.

Burton, Griffiths and Co., Ltd., Machine Tool Division, Kitts Green, Birmingham, 33. T.: Stechford 4071; and Small Tools Division, Montgomery St., Birmingham, 11. T.: Victoria 2351. Metalworking machine tools and small tools.

Carter, B. and F., and Co., Ltd., Albion Works, Bolton. T.: Bolton 23344. Counting instruments.

Chamberlain Industries, Ltd., Staffa Works, Argall Ave., Leyton, London, E.10. T.: Leytonstone 3678. Tube-bending machines, presses, hydraulic rams and pumps.

Churchill, Charles, and Co., Ltd., Coventry Rd., South Yardley, Birmingham. T.: Acocks Green 2281. Machine tools.

Churchill Machine Tool Co., Ltd., The, Broadheath, Manchester. T.: Altrincham 3262. Machine tools.

Clico, Ltd., Meadow St., Sheffield, 3. T.: Sheffield 26504-5. Airframe production tools; router cutters; twist drills.

Constructors, Ltd., Tyburn Rd., Birmingham, 24. Steel storage equipment.

Cornercroft, Ltd., Ace Works, Queen Victoria Rd., Coventry. T.: Coventry 23391. Jigs, press tools, special-process machines, gauges.

Darwins, Ltd., Tinsley, Sheffield, 9. T.: Sheffield 49049. Machine tools.

Douglas Kane, Ltd., 243 Upper St., London, N.1. T.: Canonbury 8646. Robinson locking wire, twister and Burrqwik hand deburring tools.

Dowding and Doll, Ltd., 346 Kensington High St., London, W.14. T.: Western 8077. Machine tools, injection-moulding and die-casting machines; thread-milling hobs.

Dunlop and Ranken, Ltd., 147 The Headrow, Leeds, 1. T.: Leeds 27301. Engineers' and contractors' hand-forged tools.

Edwards, F. J., Ltd., 359-361 Euston Rd., London, N.W.1. T.: Euston 5000. Machine tools and presses.

Equipment and Engineering Co., Ltd., The, 2-3 Norfolk St., Strand, London, W.C.2. T.: Temple Bar 1088. Crack detectors; Magnaflux crack detecting ink.

Ferro Enamels, Ltd., Wombourne, Wolverhampton. T.: Wombourne 2441. Furnaces for high-temperature ceramic coatings on nickel-chrome alloys and sheet iron.

Fielding and Platt, Ltd., Atlas Works, Gloucester. Hydraulic drawing, extrusion and forging presses; stretch-forming machines.

Firth Brown Tools, Ltd., Speedicut Works, Carlisle St. E., Sheffield, 4. T.: Sheffield 27151. Engineers' cutting tools.

Henderson Safety Tank Co., Ltd., The, 2 Elstree Way, Boreham Wood, Herts. T.: Elstree 1758. Jigs and tools.

Herbert, Alfred, Ltd., P.O. Box No. 30, Edgwick Works, Coventry. T.: Coventry 88781. Machine tools and equipment.

Holbrook Machine Tool Co., Ltd., 44 Martin St., Stratford, London, E.15. T.: Maryland 2451. Precision lathes.

Hopkins, E. C., Ltd., Ingleby Works, Grosvenor St. West, Birmingham, 16. Flexible shaft machines.

King, Geo. W., Ltd., Argyle Works, Stevenage, Herts. T.: Stevenage 440. Gantry cranes, conveyors, hoisting equipment and sliding-door gear, etc.

Lacy-Hulbert and Co., Ltd., Boreas Works, Beddington, Croydon. T.: Croydon 5504. Compressors, vacuum pumps, exhausters, desiccators, spray-painting equipment and pneumatic appliances.

Leytonstone Jig and Tool Co., Ltd., Leytool Works, High Rd., Leyton, London, E.10. T.: Leytonstone 5022. Jigs, fixtures and press tools and equipment.

Light Soldering Developments, Ltd., 28 Sydenham Road, Croydon, Surrey. Soldering equipment.

Loewy Engineering Co., Ltd., The, Wallisdown Rd., Bournemouth, Hants. T.: Winton 5000. Martin Marform metal-forming equipment.

Marbaix, Gaston, E., Ltd., Devonshire House, Vicarage Cres., Battersea, London, S.W.11. T.: Battersea 8888. Machine tools.

Marley, W. H., and Co., Ltd., New Southgate Works, 105 High Rd., London, N.11. T.: Enterprise 5234 and 5578. Machine-tool accessories.

Martonair, Ltd., Parkshot, Richmond, Surrey. Pneumatic equipment; air hoists.

Masson Seeley and Co., Ltd., 137-139 Euston Rd., London, N.W.1. T.: Euston 0921-7. Masseeley nameplate machines; stamping and marking machines and presses. Aircraft and engine components.

Morgan Crucible Co., Ltd., The, Battersea Church Rd., Battersea, London, S.W.11. T.: Battersea 8822. Crucibles and crucible furnaces, Morganite carbon brushes.

Morris, B. O., Ltd., Morrisflex Works, Briton Rd., Stoke, Coventry. T.: Coventry 53333. Morrisflex flexible shaft equipment, polishing lathes, backstand idlers and polishing materials; rotary files, cutters and rasps; special-purpose machines.

Neill, James, and Co. (Sheffield), Ltd., Napier St., Sheffield, 11. T.: Sheffield 26781. Hacksaw blades and frames; engineers' tools, permanent magnets and chucks.

Nettlefold and Moser, Ltd., 170-194 Borough High St., London, S.E.1. T.: Hop 7111. Electric and hand tools; transmission equipment.

Northey Rotary Compressors, Ltd., Alder Rd., Parkstone, Poole, Dorset. T.: Parkstone 4900. Blowers for electro-plating, metal polishing and spray-painting plants.

Omes, Ltd., Beverley Works, Barnes, London, S.W.13. T.: Prospect 2291. Resistance-heating equipment for forging.

Power Flexible Tubing Co., Ltd., The, Derby Works, Vale Rd., London, N.4. T.: Stamford Hill 6696. Flexible metallic tubing and couplings; flexible shaft outer casings; cable armouring; bellows-type expansion joints.

Power Jacks, Ltd., Valetta Rd., Acton, London, W.3. T.: Shepherds Bush 3443. Hydraulic jacks and pumps; Newton Hydratruck hydraulic lift trucks.

Purefoy Unit Tooling, Ltd., Upper Tilt Works, Cobham, Surrey. T.: Cobham 3013. Jig and fixture standard parts.

Randall, James H., and Son, Ltd., Paddington Green Works, London, W.2. T.: Ambassador 1661. Workshop equipment.

Robertson, W. H. A., and Co., Ltd., Lynton Works, Bedford. T.: Bedford 66271. Trimming and slitting equipment, etc.

Rollason Aerocessories, Ltd., Croydon Airport, Surrey. T.: Croydon 7238-9. Test equipment; benches, stands, etc.

Roswell, Henry, and Co., Ltd., Waverley Works, Effingham Rd., Sheffield. Jigs, fixtures and engineers' small tools.

Salter, Geo., and Co., Ltd., High St., West Bromwich. T.: West Bromwich 1855. Weighing machines and spring balances.

Schrader's Son, A., Division of Scovill Manufacturing Co., 829 Tyburn Rd., Erdington, Birmingham, 24. Tyre valves, parts; pressure gauges and air control equipment.

Scintilla, Ltd., 20 Carlisle Rd., The Hyde, Hendon, London, N.W.9. T.: Colindale 8844. Lesto portable tools, etc.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Laboratory equipment; fuel-measuring equipment; engineers' hand and machine tools. High-speed cutters, etc.

Skinners (Southampton), Ltd., Millbrook Trading Estate, Southampton. T.: Southampton 71167-8. Press tools, jigs and fixtures, gauges.

Steadall and Co., Ltd., 192-204 Pentonville Rd., London, N.1. T.: Terminus 3699. Fittings; tools; workshop equipment.

Talbot Tool Co., Ltd., "Grip" Works, Roedale Rd., Brighton, Sussex. T.: Brighton 55832. Jig bushes, layout fluid and bushes for laminate and glass-fibre jig work.

Trade Directory . . . .

Thompson, Raymond F., (Engineers), Ltd., Harlow, Essex. T.: Harlow 24341-3. All types of aircraft tooling.

Turner Brothers (Birmingham), Ltd., Galvanic Works, Cliveland St., Birmingham, 19. T.: Aston Cross 1741. Press tools, jigs, fixtures and power presses.

Vaughan, Edgar, and Co., Ltd., Legge St., Birmingham, 4. T.: Aston Cross 2071-5. Oils, compounds and salts.

Ward, H. W., and Co., Ltd., Dale Rd., Birmingham, 29. Capstan and turret lathes.

Wickman, Ltd., Banner Lane, Tile Hill, Coventry. T.: Coventry 65231. Automatic lathes, tool-grinding machines; diamond-impregnated grinding wheels; Wimet tools; dies, press tools, etc.

Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T.: Gloucester 24021. Air compressors.

Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, Ealing, London, W.5. T.: Perivale 5631. Portable electric tools.

Young, A. S., and Co., Ltd., Tower Works, Woodside Lane, London, N.12. T.: Hillside 6606-7. Oxy-acetylene welding and cutting equipment, rods and accessories.

5—Controls, Systems and Accessories

A.B.C. Motors, Ltd., Walton-on-Thames, Surrey. T.: Walton-on-Thames 23774-6. Auxiliary power units; refuelling units for seaplanes, etc.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfields 4571. Ball and roller joints, flexible distance controls, float chambers, jet calibrating machines, flowmeter, injectors and carburetters.

Aren Controls, Ltd., Trowers Way, Holmethorpe, Redhill, Surrey. T.: Redhill 5511-4. Remote controlling gear; operating boxes and fittings.

Astralux, Ltd., Brightlingsea, Essex. T.: Brightlingsea 417. Pitôt pressure heads; terminal blocks; oxygen flow indicators; clamps.

Blocktube Controls, Ltd., Bicester Road, Aylesbury, Bucks. T.: Aylesbury 3494-6. Mechanical controls.

British Ermeto Corporation, Ltd., The, Beacon Works, Hargrave Rd., Maidenhead, Berks. T.: Maidenhead 5100-10. High-pressure pipe couplings; shut-off and flow-control valves; flexible hoses and end fittings.

Coventry Victor Motor Co., Ltd., Coventry. T.: Coventry 5054-6. Auxiliary powerplant prime movers.

Dumic Controls, Ltd., 268 High St., Uxbridge, Middx. T.: Uxbridge 32100 and 35432. Hydraulic and air valves for low and high pressures, including changing, non-return, relief and solenoid operated.

Duval, S., and Sons, Ltd., 8-12 Wadsworth Rd., Greenford, Middx. T.: Perivale 7807-8. Precision engineering specialists in cyclic and other time-switch devices.

Dragonair, Ltd., Fitzherbert Rd., Farlington, Portsmouth. T.: Cosham 76451-3. Dragonfly heating and deicing systems; Dragonair heating and ventilating systems.

Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4. T.: Chiswick 3670. Electrical controls for throttle, v.p. airscrews, tabs, flaps, etc.; gas turbine speed controllers and governors.

Godden, M. H. (Cheltenham), Ltd., Bouncers Lane, Cheltenham, Glos. T.: Cheltenham 7202-3. De-icing equipment.

Hale, Hamilton (Valves), Ltd., Frays Mill Works, Cowley Rd., Uxbridge, Middx. T.: Uxbridge 36525-6. Pressure reducing and solenoid valves; pressure-control equipment.

Harvey Electronics, Ltd., Farnborough Rd., Farnborough, Hants. T.: Farnborough 1120. Servo units, bulk erasers for magnetic tape; specialized electronic and electro-mechanical devices.

Keelavite Hydraulics, Ltd., Allesley, Coventry. T.: Meriden 441. Keelavite hydraulic pumps, motors, cylinders and control gear.

R.M.R. Engineering, Brook St., Tring, Herts. T.: Tring 3338-9 and 3381-2. Pipeline unions and couplings.

Rist's Wires and Cables, Ltd., Lower Milehouse Lane, Newcastle, Staffs. T.: Newcastle 51221-9. Aircraft cables and cable assemblies; engine harnesses; moulded electrical assemblies.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Electric motors; air-pressure and vacuum pumps, etc.

Seton Creaghe Engineering, Ltd., Trading Estate, Park Royal Rd., London, N.W.10. T.: Elgar 3356-7. High-precision electro-mechanical devices and mechanisms.

Thermotank, Ltd., 150 Helen St., Glasgow, S.W.1. Air-conditioning plant.

Turner Manufacturing Co., Ltd., Wulfruna Works, Villiers St., Wolverhampton. T.: Wolverhampton 24456. Oleo compression legs, jacks, hydraulic retracting mechanism, undercarriages; vacuum and hydraulic pumps; flying controls.

Valley-FMC, Ltd., Ferry Lane, Brentford, Middx. T.: Isleworth 3922-8. Pumping equipment; petrol dispensing units.

White, S. S., Dental Manufacturing Co. (G.B.), Ltd., The (Industrial Division), Third Avenue, Denbigh Rd., Bletchley, Bucks. T.: Bletchley 3295. Torsional flexible remote controls and flexible shaft assemblies for engine speed indicators.

6—Instrument Equipment

Accurate Recording Instrument Co., Aric Works, Windsor Avenue, Merton, London, S.W.19. T.: Liberty 5661. Mechanical dial-type instruments and controls.

Aircraft Supplies (Bournemouth), Ltd., Dalkeith Hall, 81 Old Christchurch Road, Bournemouth, Hants. T.: Bournemouth 21272. Aircraft instrument, electrics and general spares stockists.

A.J.W. (Instruments), Ltd., The Drive, Horley, Surrey. T.: Horley 1423. Aircraft instruments.

Ancillary Developments, Ltd., Ancilco Works, Surrey Avenue, Camberley, Surrey. T.: Camberley 3443. Precision wirewound resistors and potentiometers.

Appleby and Ireland, Ltd., Basingstoke, Hants. T.: Basingstoke 2510. Aircraft and scientific instruments; pressure responsive elements.

Aron Meters, Ltd., 72-82 Salusbury Road, Kilburn, London, N.W.6. T.: Maida Vale 0182-8. Aircraft instruments.

Avimo, Ltd., Taunton, Somerset. T.: Taunton 3634-5. A.S.I. pressure heads, pipe couplings for coolant, oil and fuel pipe lines; film assessors and analysers; electronic apparatus.

Barnet Instruments, Ltd., Bath Place, Barnet, Herts. T.: Barnet 0066. Pressure, vacuum and compound gauges, and testing equipment.

British Rototherm Co., Ltd., The, Merton Abbey, London, S.W.19. T.: Liberty 7661. Rototherm dial-type bi-metallic and distance-reading temperature gauges and recorders.

Browne, Henry, and Son, Ltd., Station Works, Barking, Essex. T.: Rippleway 4054-6. Sestrel aero compasses and other instruments.

Carter, B. and F., and Co., Ltd., Albion Works, Bolton, 17, Lancs. T.: Bolton 23344. Industrial counters and measuring instruments; centrifugal clutches and variable speed units.

Cooke, Troughton and Simms, Ltd., Haxby Rd., York. T.: York 24112. Microscopes.

Counting Instruments, Ltd., 5 Elstree Way, Boreham Wood, Herts. T.: Elstree 4151. Mechanical and electro-magnetic counters, etc. Number wheels and pinions for aircraft instruments.

Dawe Instruments, Ltd., 99-101 Uxbridge Rd., Ealing, London, W.5. T.: Ealing 5215-7. Electronic measuring instruments; dynamic balancing machines; stroboscopes; sound and vibration measuring equipment; ultrasonic cleaning and non-destructive test equipment.

Dent and Co., and Johnson, Ltd., Linwood, Renfrewshire. T.: Johnstone 109. Dent-Johnson compasses, etc.

Engel and Gibbs, Ltd., Elstree Way, Boreham Wood, Herts. T.: Elstree 2291. Thermal and levelling switches.

Epsylon Industries, Ltd., Faggs Rd., Feltham, Middx. T.: Feltham 5091. Instrumentation; magnetic recording equipment; digital data logging and processing units; Video systems.

Inertia Switch, Ltd., 46 Kingsway, London, W.C.2. T.: Chancery 3759. Guided weapon instruments.

K.D.G. Instruments, Ltd., Manor Royal, Crawley, Sussex. T.: Crawley 25151. Aircraft instruments.

Kent, George, Ltd., Biscot Rd., Luton, Beds. T.: Luton 2449. Flow meters, etc.

Langham Thompson, J., Ltd., 176 High Rd., Bushey Heath, Herts. T.: Bushey Heath 2411. Transducers; oscilloscope and high-speed recording cameras, meters and voltage regulators.

Measuring Instruments (Pullin), Ltd., Electrin Works, Winchester St., Acton, London, W.3. T.: Acorn 4651. Electrical indicating instruments, relays, test and control gear.

Mechanism, Ltd., Gyro Works, George Street, Croydon, Surrey. T.: Croydon 34269. Aeronautical, meteorological and industrial instruments.

Munro, R. W., Ltd., Bounds Green, London, N.11. T.: Enterprise 4422. Flight-record instruments, indicators and calibrators.

Page Engineering Co. (Sunbury-on-Thames), Ltd., Page Works, Forge Lane, Sunbury-on-Thames, Middx. T.: Sunbury-on-Thames 4242. Moving-coil relays, measuring instruments, thermometers, etc.

Painton and Co., Ltd., Kingsthorpe, Northampton. T.: Northampton 34251. Electrical components.

Power Flexible Tubing Co., Ltd., The, Derby Works, Vale Rd., London, N.4. T.: Stamford Hill 6696. Flexible metallic bellows; temperature-control apparatus, fuel pumps.

Reid and Sigrist, Ltd., Braunstone Works, Braunstone, Leicester. T.: Leicester 858101-5. Aeronautical instruments; specialists in gyroscopic instruments and test gear.

Rotameter Manufacturing Co., Ltd., Purley Way, Croydon, Surrey. T.: Croydon 3816. Flow meters.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Gyro and meteorological instruments, solenoids, simulator equipment.

Specto, Ltd., Vale Rd., Windsor, Berks. T.: Windsor 1241. Electrical, electronic, tape recording, laboratory and optical instruments; aircraft cine cameras.

Stanley, W. F., and Co., Ltd., Avery Hill Rd., New Eltham, London, S.E.9. T.: Eltham 3836. Instruments.

Telford Products, Ltd., Telford Way, East Acton, London, W.3. T.: Shepherds Bush 1915. Camera and electronic instrumentation.

Test Equipment, Ltd., Gatwick Rd., Crawley, Sussex. T.: Crawley 2350. Wind tunnel balances and equipment.

H. Tinsley and Co., Ltd., Werndee Hall, South Norwood, London, S.E.25. Precision electrical measuring instruments.

Turner, Ernest, Electrical Instruments, Ltd., Chiltern Works, Totteridge Avenue, High Wycombe, Bucks. T.: High Wycombe 1301-4. Electrical measuring instruments; electronic flash discharge and stroboscopic equipment.

Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T.: Gloucester 24021. Reducing valves and pressure regulators; W. and J. "Pneumerstat."

Wynstruments, Ltd., Staverton Aerodrome, Gloucester. T.: Churchdown 3264. Control and instrumentation engineers.

7—Electronic and Electrical Equipment

Aerocontacts, Ltd., Gatwick House, Horley, Surrey. T.: Horley 4455. Electrical and radio equipment.

Aeronautical Radio Services, Ltd., Doman Rd., Camberley, Surrey. T.: Camberley 2341. Aircraft radio and radar.

Air Transport (Charter) (C.I.), Ltd., 7 Willow Rd., Poyle Trading Estate, Colnbrook, Bucks. T.: Colnbrook 2654-6. Specialized electronic test equipment; radio and radar communications and navaids.

Anticoustic Co., The, 7 Millmead, Guildford, Surrey. T.: Guildford 66488. Electrical and electronic equipment; ear defenders and sound insulators; acoustic booths and soundproof cabinets.

Automatic Coil Winder and Electrical Equipment Co., Ltd., 92-96 Vauxhall Bridge Rd., London, S.W.1. T.: Victoria 0835. Electrical and electronic test equipment; coil-winding machines.

Bonelin, D. H., and Son, Ltd., West Hill, Hoddesdon, Herts. T.: Hoddesdon 2283. Electrical accessories.

Bradley, G. and E., Ltd., Electral House, Neasden Lane, London, N.W.10. T.: Dollis Hill 7811. Tacan and DME test sets; semi-conductor devices.

British Electric Resistance Co., Ltd., Queensway, Ponders End, Middx. T.: Howard 2411. Resistors, rheostats, potentiometers, variable transformers, etc.

(*Continued on page* 289)

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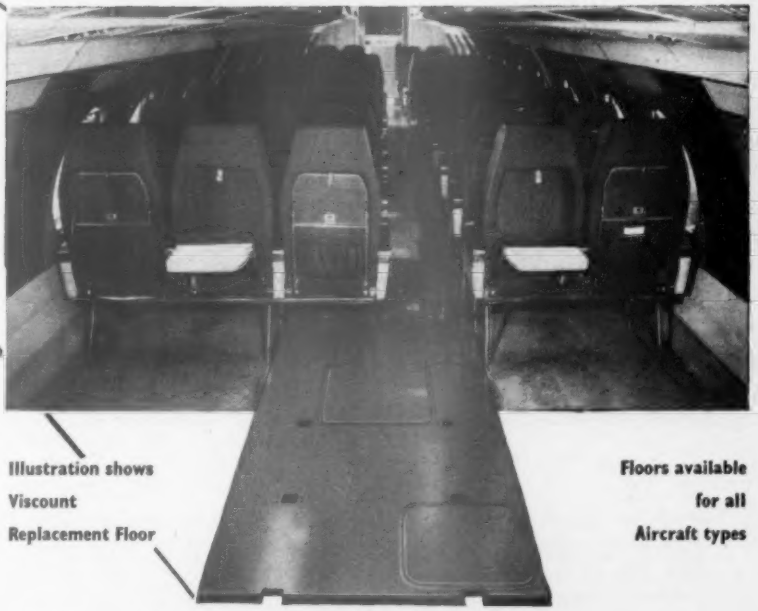

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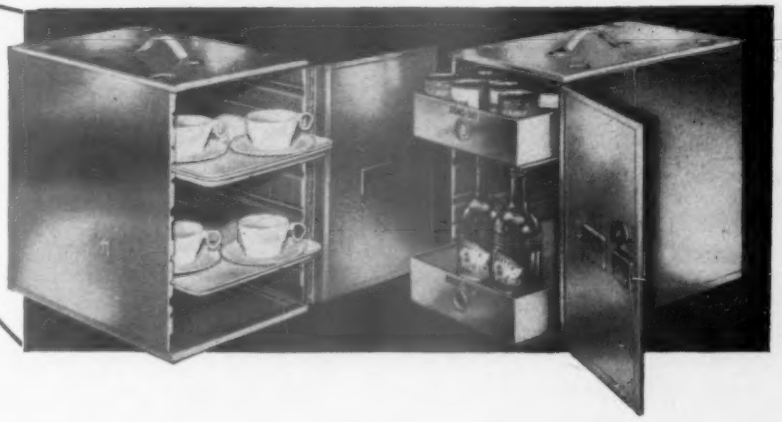

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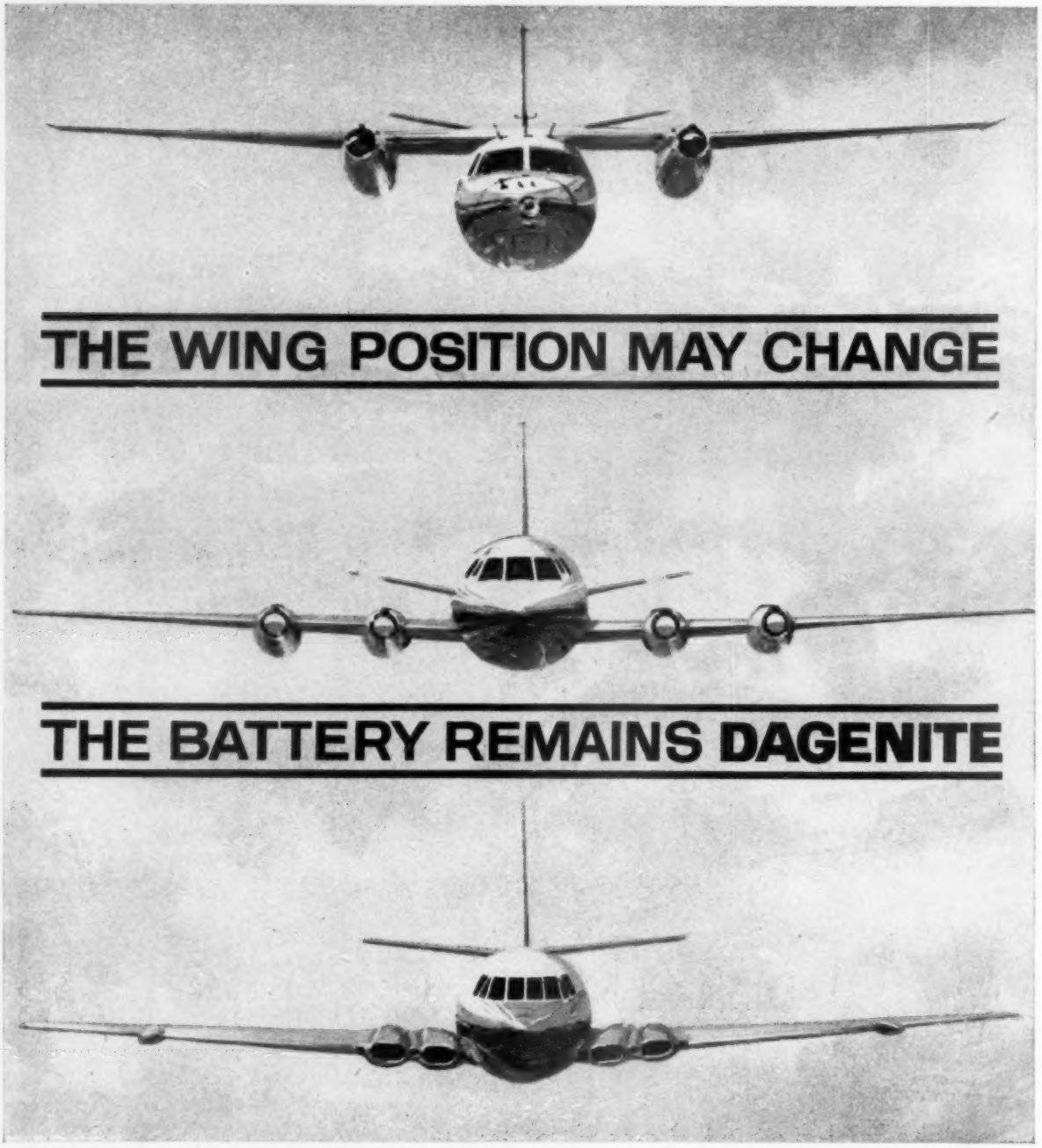

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Trade Directory . . . .

(*Continued from page* 288)

C. and N. (Electrical), Ltd., The Green, Gosport, Hants. T.: Gosport 80221-5. Electronic and electrical equipment; pneumatic tube systems.

Cannon Electric (Gt. Britain), Ltd., 168-172 Old St., London, E.C.1. T.: Clerkenwell 4954. Electrical connectors for a wide range of applications.

Cathodeon Crystals, Ltd., Linton, Cambs. T.: Linton 501. Quartz crystal units.

Cathodeon, Ltd., Church St., Cambridge. T.: Cambridge 56481. Fire-protection and high-voltage high-speed evacuated relay switches.

C. P. Clare, Ltd., 70 Dudden Hill Lane, Willesden, London, N.W.10. T.: Willesden 5141. Electro-magnetic relays.

C.W.C. Equipment, Ltd., Kings Grove, Maidenhead, Berks. T.: Maidenhead 2275. Toggle switches and connectors; wiring systems.

Davis and Timmins (Aircraft), Ltd., Billet Rd., Walthamstow, London, E.17. T.: Larkswood 2313. Electrical parts.

Eastern Aero Electrical Services, Ltd., Priory St., Colchester, Essex. T.: Colchester 6173. Aircraft electrical component supply and repair specialists.

Electronic Components, Weedon Rd., Industrial Estate, Northampton. T.: Northampton 1873-4. Faders, attenuators, switches, etc.

E.R.S. (London), Ltd., 159 Brookwood Rd., London, S.W.18. T.: Vandyke 4366-9. Electrical connectors of all types; terminations; prefabricated wiring looms; aerial kits; encapsulation; insulator assemblies.

Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4. T.: Chiswick 3670. Electrical controls and test sets.

Harvey Electronics, Ltd., Farnborough Rd., Farnborough, Hants. T.: Farnborough 1120. Servo mechanisms; power-supply units, etc.

International Aeradio, Ltd., 40 Park St., London, W.1. T.: Hyde Park 5024. Telecommunications, radio and radar aids.

Land, Air and Sea Instruments Co., Ltd., 328 Grand Buildings, Trafalgar Sq., London, W.C.2. T.: Whitehall 4864. Lascom aircraft radio communication and navigation equipment; VHF radio telephones.

Lyon, Arthur, and Co. (Engineers), Ltd., 6 Carlos Place, Grosvenor Sq., London, W.1. T.: Hyde Park 9141. Generator test benches and inverter testers.

Magnetic Devices, Ltd., Exning Rd., Newmarket. T.: Newmarket 3451-61. Relays, contactors, solenoids, connectors, rotary transformers.

M.B. Metals, Ltd., Vale Works, Portslade, Sussex. T.: Hove 48623-5. Plugs and sockets; aircraft lighting equipment; suppressors; moulded and butted connectors; guided weapon components; pressure switches; electro-magnetic and electronic devices.

McMichael Radio, Ltd., Wexham Rd., Slough, Bucks. T.: Slough 24541. Radio, electronic and electrical equipment and ancillaries; electronic instrumentation; aircraft suppressors.

Mullard Equipment, Ltd., Mullard House, Torrington Place, London, W.C.1. T.: Langham 6633. Specialized electronic equipment for communications and nucleonics.

Nife Batteries, Redditch, Worcs. T.: Redditch 2351. Nife nickel cadmium alkaline batteries for telemetry, guidance and alarm systems, guided missile control.

N.S.F., Ltd., Remax House, Alfred Place, London, W.C.1. T.: Langham 9561. N.S.F.-Oak and Cutler hammer switches, etc.

Oldham and Son, Ltd., Hyde Rd., Denton, Manchester. T.: Denton 2431. Portable lighting; accumulators and batteries.

Page Engineering Co. (Sunbury-on-Thames), Ltd., Page Works, Forge Lane, Sunbury-on-Thames, Middx. T.: Sunbury - on - Thames 4242-4. Switches; sealed relays; indicator lamps; lamp and fuse holders; warning and call systems.

Painton and Co., Ltd., Kingsthorpe, Northampton. T.: Northampton 34251. Attenuators and faders; switches; terminals, plugs and sockets; wire-wound potentiometers, midget RF chokes, etc.

Parker, W. A., (Aircraft Spares), Ltd., Manor Trading Estate, Church Rd., Thundersley, Essex. T.: South Benfleet 2681. Aircraft electrical spares stockists.

Philips Electrical, Ltd., Century House, Shaftesbury Ave., London, W.C.2. T.: Gerrard 7777. Electrical equipment.

Piezo, Ltd., 26 St. Albans Rd., Watford, Herts. T.: Watford 27808. Quartz crystals for radio frequency control.

Racal, Ltd., Western Av., Bracknell, Berks. T.: Bracknell 941. Electronic equipment.

Rist's Wires and Cables, Ltd., Lower Milehouse Lane, Newcastle, Staffs. T.: Newcastle 51221-9. Cable and cable assemblies and looms, etc.

Santon, Ltd., Somerton Works, Newport, Mon. T.: Newport 71211. Rotary switches, etc.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. General electrical equipment; plugs, switches, etc.

Siemens Edison Swan, Ltd., 33 Grosvenor Place, London, S.W.1. T.: Belgravia 1234. Electrical cables; telecommunications, signal and lighting equipment.

Simon Equipment, Ltd., 48 George St., Portman Sq., London, W.1. T.: Welbeck 2371. Magnetic monitoring equipment, timing injector units, etc.

Technograph Printed Circuits, Ltd., 29 Regent St., London, S.W.1. T.: Regent 5273. Printed circuits.

Walters Electrical Mfg. Co., Ltd., Kensal Rd., London, W.10. T.: Ladbroke 2323-4. Electrical and telegraph engineers.

Wayne Kerr Laboratories, Ltd., Roebuck Rd., Chessington, Surrey. T.: Lower Hook 1131. Electronic equipment, particularly for measuring.

Westool, Ltd., St. Helen's Auckland, Co. Durham. T.: West Auckland 551-7. Solenoids; electro-magnetic clutches; eddy-current couplings; transformers; ultrasonic sensing and switching devices; control gear; coils and coil-winding machines.

8—*Survival Equipment and Flying Clothing*

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Parachutes; air/sea rescue packs. R.A.F. web equipment, kitbags, haversacks.

Black and Decker, Ltd., Harmondsworth, Middx. T.: Skyport 2411-9. Air-rescue saws.

British Parachute Co., Ltd., Chapeltown St., Manchester, 1. T.: Ardwick 2414. Parachutes; general aircraft safety equipment.

Elliott Equipment, Ltd., Altona Works, Lisburn, N. Ireland. T.: Lisburn 2711-5. Air/sea rescue equipment.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Folding dinghies.

Helmets, Ltd., Moat Factory, Wheathampstead, Herts. T.: Wheathampstead 2221-3. Protective headwear and ancillary equipment.

Flint, Howard, Ltd., 18 Grosvenor St., London, W.1. T.: Mayfair 3282 and 2685. Flying clothing of all types.

Lea Bridge Industries, Ltd., Priory Works, Arterial Rd., Southend-on-Sea. T.: Eastwood 525265. Air/sea rescue equipment, parachutes, Lindholme gear, etc.

Lewis, D., Ltd. (Dept. F), 124 Gt. Portland St., London, W.1. T.: Museum 4314. Flying suits, goggles and gloves. Oxygen equipment.

Permutit Co., Ltd., The, Gunnersbury Av., London, W.4. T.: Chiswick 6431. Drinking-water filters; de-salting kits.

Vosper, Ltd., Portsmouth, Hants. T.: Cosham 79481. Seaplane and crash rescue tenders; firefloats; air/sea rescue launches; airborne lifeboats.

WAECO, Ltd. (Marine Division), High Post, Salisbury, Wilts. Marine distress signals; air/sea rescue equipment.

9——*Miscellaneous Equipment and Services*

A.B.C. Motors, Ltd., Walton-on-Thames, Surrey. T.: Walton-on-Thames 23774-6. Auxiliary power units pumping and generating sets; bilging and refuelling units for seaplanes.

Abbey Panel and Sheet Metal Co., Ltd., Bayton Rd., Exhall, nr. Coventry. T.: Bedworth 2071. Prototype and experimental work.

Aerogalley, Ltd. (Proprietors: Aerocontacts (Aircraft Distributors), Ltd.), Gatwick House, Horley, Surrey. T.: Horley 4455. Aircraft catering equipment.

Aerolex, Ltd., Bridge Rd., Camberley, Surrey. T.: Camberley 1500. Quick-release lashing equipment; stretcher equipment; safety belts.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. R.A.F. banner and drogue targets; aircraft furnishings; kapok cushions.

Airwork Services, Ltd., 35 Piccadilly, London, W.1. T.: Regent 8494. Aircraft servicing, maintenance, etc.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791. Experimental design and production; airframe and engine repair.

British Replin, Ltd., 2 South Audley St., London, W.1. T.: Grosvenor 6692. Manufacturers of upholstery fabrics.

Brooklands Aviation, Ltd., Weybridge, Surrey. T.: Weybridge 3821. Repair and overhaul of civil and military aircraft.

Bury Felt Manufacturing Co., Ltd., Hudcar Mills, Bury, Lancs. Upholstery, carpeting, felts, strips, gaskets, washers and plastic foam.

Camerer Cuss and Co., 56 New Oxford St., London, W.1. T.: Museum 8968. Aircraft clocks.

Cox, John, and Son, Ltd., 17 Carlisle Rd., London, N.W.9. T.: Colindale 4001. Aircraft cloth and trimming.

Cullum Detuners, Ltd., 58 Highgate West Hill, London, N.6. T.: Fitzroy 1221. Test-bed silencing, detuners, mufflers, intake splitter systems, run-up pens.

Elsan Manufacturing Co., 51 Clapham Rd., London, S.W.9. Toilet units and chemical fluids.

Fisons Pest Control, Ltd., Harston, Cambs. T.: Harston 312. Chemicals for aerial crop spraying.

Harper, C. E., Aircraft Co., Ltd., Exeter Airport, Clyst Honiton, Devon. T.: Exeter 67451. Aircraft service and maintenance.

Ilford, Ltd., Ilford, Essex. T.: Ilford 3000. Photographic sensitized materials, equipment and chemicals.

Inferation, Ltd., Yorktown Industrial Estate, Camberley, Surrey. T.: Camberley 2354. Aircraft galley and cabin-heating equipment.

International Aeradio, Ltd., 40 Park St., London, W.1. T.: Hyde Park 5024. Maps and map mountings. Aerad flight guides; route manuals, air-mileage handbooks, etc.

Kodak, Ltd., Kodak House, Kingsway, London, W.C.2. T.: Holborn 7841. Photographic equipment.

London Name Plate Manufacturing Co., Ltd., The, Zylo Works, Brighton, Sussex. T.: Brighton 67025. Name-plates, engraved notices, plastic signs.

Mallock-Armstrong Co., 7 Millmead, Guildford, Surrey. T.: Guildford 66488. Ear defenders.

Mason, E. N., and Sons, Ltd., Arclight Works, Colchester, Essex. T.: Colchester 5191. Photo-copying and drawing-office equipment.

Mavitta Drafting Machines, Ltd., Highlands Rd., Shirley, nr. Birmingham. T.: Solihull 2231. Drawing-office equipment.

M.B. Packaging, Ltd., North Rd., Lancing, Sussex. T.: Lancing 2838. Fully approved design, development, test and production of packaging contractors.

Middleton Sheet Metal Co., Ltd., Spring Vale Works, Middleton, Manchester. T.: Middleton 2427-8. Navigators' tables and seats.

Power Jets (Research and Development), Ltd., 25 Green St., London, W.1. T.: Mayfair 7801. Management of gas-turbine patents; consultants.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Mellor 666. Drawing-office services; airframe and engine overhaul, servicing and maintenance; seats; packaging, etc.

Stuart, Robert, (London), Ltd., Ascham St., Kentish Town, London, N.W.5. T.: Gulliver 6141. Metal-finishing specialists.

Technical Platings, Ltd., Craigs Works, Luther Rd., Teddington, Middx. T.: Teddington Lock 4381-4. Anti-corrosion finishes.

Thermotank, Ltd., Helen St., Glasgow, S.W.1. T.: Govan 2444. Plastic and metal punkah louvres.

Tiltman Langley, Ltd., Redhill Aerodrome, Surrey. T.: Nutfield Ridge 2232. Research and development engineers; production of aircraft components.

Transport Seating, Ltd., Western Works, Bromley St., Birmingham, 9. T.: Victoria 5901-3. Aircraft seats, upholstery, furnishing and escape chutes.

10—*Airport Construction and Equipment*

Access Equipment, Ltd., Maylands Ave., Hemel Hempstead, Herts. T.: Boxmoor 5781. Giraffe hydraulic mounting mobile platforms; Safety Raiser adjustable platforms; zip-up aluminium staging.

Aerocontacts (Ground Equipment), Ltd., Gatwick House, Horley, Surrey. T.: Horley 4455. Aircraft ground equipment.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Aircraft weather-proof covers; portable hangars.

Aircraft Ground Equipment, Ltd., Blacksworth Rd., Bristol, 5. T.: Bristol 58408. Aircraft starters and ground power units; electrical system and hydraulic test rigs; generating plant and servicing trucks; passenger loading stands.

Angus, George, and Co., Ltd., Angus House, Newcastle upon Tyne. T.: Newcastle upon Tyne 22656-9. Fire-fighting equipment and protective clothing.

Trade Directory . . . .

Austinlite, Ltd., Crawley, Sussex. Automatic stand-by generating sets; radar installations.

Aviation Traders (Engineering), Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791. Hangarage; airport freight and passenger handling equipment.

Bellman Hangars, Ltd., Hobart House, Grosvenor Place, London, S.W.1. T.: Sloane 5259. Hangars, large-span buildings and unit construction.

Bolton Gate Co., Ltd., Waterloo St., Bolton, Lancs. T.: Bolton 4240. Bolton top-hung power-operated doors; shutter doors and collapsible gates.

Brockhouse, J., and Co., Ltd., Victoria Works, Hill Top, West Bromwich, Staffs. T.: Wednesbury 0243. Lewin sprinkler sweepers; trailers.

Butlers, Ltd., Atlantic Works, Grange Rd., Small Heath, Birmingham, 10. T.: Victoria 3491-6. Airfield and ground equipment lighting.

Conveyancer Fork Trucks, Ltd., Liverpool Rd., Warrington, Lancs. T.: Warrington 35241. Fork-lift trucks; electric tractors and load-handling equipment.

Coseley Engineering Co., Ltd., Dock Meadow Drive, Lanesfield, Wolverhampton. T.: Bilston 41927-9. Prefabricated hangars, etc.

Costain, Richard, Ltd., 111 Westminster Bridge Rd., London, S.E.1. T.: Waterloo 4977. Building and civil-engineering contractors.

Coventry Climax Engines, Ltd., Widdrington Rd., Coventry. T.: Coventry 28481. Fork-lift trucks and trailer fire pumps; generating sets, stationary pumps.

Creed and Co., Ltd., Telegraph House, Croydon, Surrey. T.: Municipal 2424. Teleprinters, high-speed Morse and facsimile communication equipment.

Dialled Despatches, Ltd., The Green, Gosport, Hants. T.: Gosport 80221. Document transmitting systems.

Dutton, H. W., and Co., Ltd., 25 Victoria St., London, S.W.1. T.: Abbey 1822. Heating and ventilation.

Esavian, Ltd., Esavian Works, Stevenage, Herts. T.: Stevenage 500. Sliding and folding doors.

Fire Armour, Ltd., 9 George St., London, W.1. T.: Welbeck 3313. Crash tenders, fire-fighting and rescue vehicles; pumps, etc.

General Fire Appliance Co., Ltd., St. Florian House, George St., Croydon, Surrey. T.: Croydon 2273. Fire-fighting equipment.

Head Wrightson Stockton Forge, Ltd., Stockton Forge Works, Norton Rd., Stockton-on-Tees. T.: Stockton 65268. Light-alloy hangars and aircraft-handling equipment.

Heston Aircraft and Associated Engineers, Ltd., Heston Airport, Hounslow, Middx. T.: Hayes 3844. Ground equipment.

Hills Bros. (Service), Ltd., 27 Beaconsfield Rd., Acton Green, London, W.4. T.: Chiswick 2235. Hillibro flight indicator boards.

I.T.D., Ltd., Webb Lane, Hall Green, Birmingham, 28. T.: Springfield 2282. Stacatruc fork-lift trucks; Electricar platform trucks Powrworker platform, pallet and fork-lift trucks; Portapal pallet transporters.

Laing, John, Construction, Ltd., Bunns Lane, London, N.W.7. T.: Mill Hill 3636. Airbase construction.

Lansing Bagnall, Ltd., Basingstoke, Hants. T.: Basingstoke 1010. Fork-lift trucks, tractors and trailers.

Londex, Ltd., Anerley Works, 207 Anerley Rd., London, S.E.20. T.: Sydenham 3111. Aerodrome signalling equipment, lighting, beacons.

Mercury Airfield Equipment, Ltd., The Quay, Gloucester. T.: Gloucester 24451-2. Operational and maintenance ground equipment including engine stands, maintenance docks, steps and platforms; water bowsers, baggage trucks; Jetway telescopic passenger corridors.

Mercury Truck and Tractor Co., Ltd., The Quay, Gloucester., T.: Gloucester 24451-2. Diesel- and petrol-engined tractors and trucks for aircraft towing and general ground movement; elevating platform trucks; trailers.

Merryweather and Sons, Ltd., Greenwich High Rd., London, S.E.10. T.: Tideway 1016. Fire-fighting equipment; extendable servicing platforms.

New Welbeck, Ltd., Moulsecoomb Way, Brighton, 7, Sussex. T.: Brighton 61666. Vacuum cleaners; blowers and sprayers.

Parsons, S., and Co., Ltd., Young St., Bradford, Yorks. T.: Bradford 45494. Aircraft and engine weighing and c. of g. checking equipment; airport weighing equipment of all types.

Partridge, Wilson and Co., Ltd., Davenset Electrical Works, Evington Valley Rd., Leicester. T.: Leicester 37291. Mains-operated ground starting rectifier trucks; automatic battery charging rectifiers for forklift trucks and tractors.

Petbow, Ltd., Sandwich, Kent. T.: Sandwich 3311. Aircraft ground-servicing power plant; automatic stand-by generating plant; aircraft starting and towing units.

Ransomes Sims and Jefferies, Ltd., Orwell Works, Ipswich. T.: Ipswich 54711. Aerodrome preparation and maintenance machinery.

Rediffusion Industrial Services, Ltd., Stratton House, Stratton St., London, W.1. T.: Mayfair 8876. Public address systems and Rediffusion wired broadcasting service.

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Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Mellor 666. Hangarage; assembly and maintenance platforms and stagings, etc.

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Steel Barrel Co., Ltd., The, Phoenix Works, Uxbridge, Middx. T.: Uxbridge 38535. Aircraft fuellers and servicers.

Steels Engineering Products, Ltd., Crown Works, Sunderland. T.: Sunderland 56281. Coles mobile cranes.

Stone-Chance, Ltd., Gatwick Rd., Crawley, Sussex. T.: Crawley 25251. Aerodrome location beacons, hazard beacons.

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Taylor, C. F. (Metal Workers), Ltd., Molly Millars Lane, Wokingham, Berks. T.: Wokingham 1005-6. Aircraft servicing trolleys; refuelling equipment; passenger steps.

Thompson Bros. (Bilston), Ltd., Bilston, Staffs. Aircraft refuellers; transport and storage tanks.

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Wimpey, George, and Co., Ltd., Hammersmith Grove, London, W.6. T.: Riverside 2000. Airfield construction.

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11—*Fuels and Oils*

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Duckham, Alexander, and Co., Ltd., Hammersmith, London, W.6. T.: Fulham 3300. Lubricants and greases.

Gulf Oil (Great Britain), Ltd., Grosvenor Pl., London, S.W.1. T.: Belgravia 5011. Aero-engine oils; aircraft control oils and greases.

Laporte Chemicals, Ltd., Kingsway, Luton, Beds. T.: Luton 4390. H.T.P. rocket fuel oxidant.

Mobil Oil Co., Ltd., Caxton House, Westminster, London, S.W.1. T.: Whitehall 1010. Aircraft engine oils, Mobil Aero fluids, Mobil greases and Mobil industrial and automotive lubricants.

Ragosine Oil Co., Ltd., Rocol House, Swillington, Leeds. T.: Garforth 2261. Lubricants.

Regent Oil Co., Ltd., 117 Park St., London, W.1. T.: Mayfair 8474. Distributors of petroleum products.

Sternol, Ltd., Royal London House, Finsbury Sq., London, E.C.2. T.: Monarch 3871. Soluble, straight-cutting, quenching and rust-preventive oils.

Vacuum Oil Co., Ltd., Caxton House, Westminster, London, S.W.1. T.: Whitehall 1010. Mobiloil Aero aero-engine oils, fluids and specialities; Mobilgreases.

Vaughan, Edgar, and Co., Ltd., Legge St., Birmingham, 4. Aston Cross 2071-5. Oils and compounds for metal working; heat-treatment oils and salts.

12—*Paints, Cleaners and Finishing Processes*

Acorn Anodising Co., Ltd., Durham Rd., Boreham Wood, Herts. T.: Elstree 5433. Anodisers.

Alumilite and Alzak, Ltd., Station Rd., Merton Abbey, London, S.W.19. T.: Liberty 7641. Anodising, electro-brightening; decorative finishes.

Bennett (Hyde), Ltd., Boston Mills, Hyde, Cheshire. T.: Hyde 1377-9. Degreasants; decarbonizing compound.

Berger, Lewis (Great Britain), Ltd., Berger House, Berkeley Sq., London, W.1. T.: Mayfair 9171. Paint, varnishes, cellulose, synthetic enamels and aircraft dopes and finishes.

Berk, F. W., and Co., Ltd., Brent Crescent, North Circular Rd., London, N.W.10. T.: Elgar 3533. Abrasives; building-up equipment; metal spraying and equipment, etc. Schori process.

Blundell, Spence and Co., Ltd., Industrial Division, York House, 37 Queen Square, London, W.C.1. T.: Chancery 6877. Vulcan transport finishes and Offkwik paint remover.

Chromium and Anodic Finishes, Ltd., 36 Ashbrook Rd., Upper Holloway, London, N.19. T.: Archway 1688-9. Electro-chemical processors specializing in anodic treatment of aluminium and its alloys.

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Hadfields (Merton), Ltd., Western Rd., Mitcham, Surrey. T.: Mitcham 3422. Enamels, paints, varnishes and lacquers; decorative finishes.

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Ryland, Llewellyn, Ltd., Ballsall Heath Works, Haden St., Birmingham, 12. T.: Calthorpe 2284-6. Paints, varnishes, enamels; polyester colour pastes; Durlac jointing compound.

Sternol, Ltd., Royal London House, Finsbury Square, London, E.C.2. T.: Monarch 3871. Barrier creams and hand cleansers.

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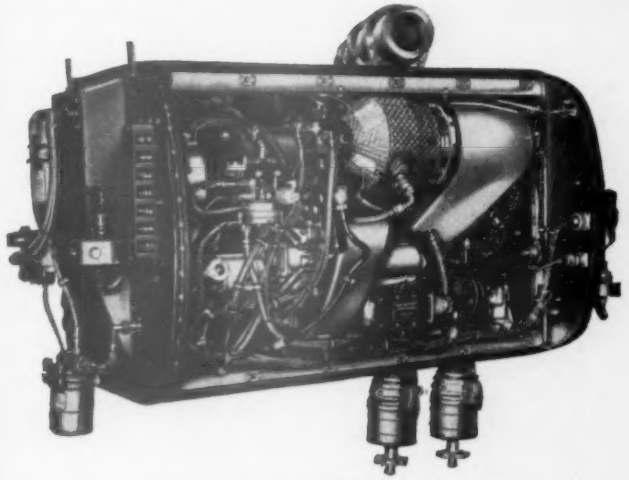

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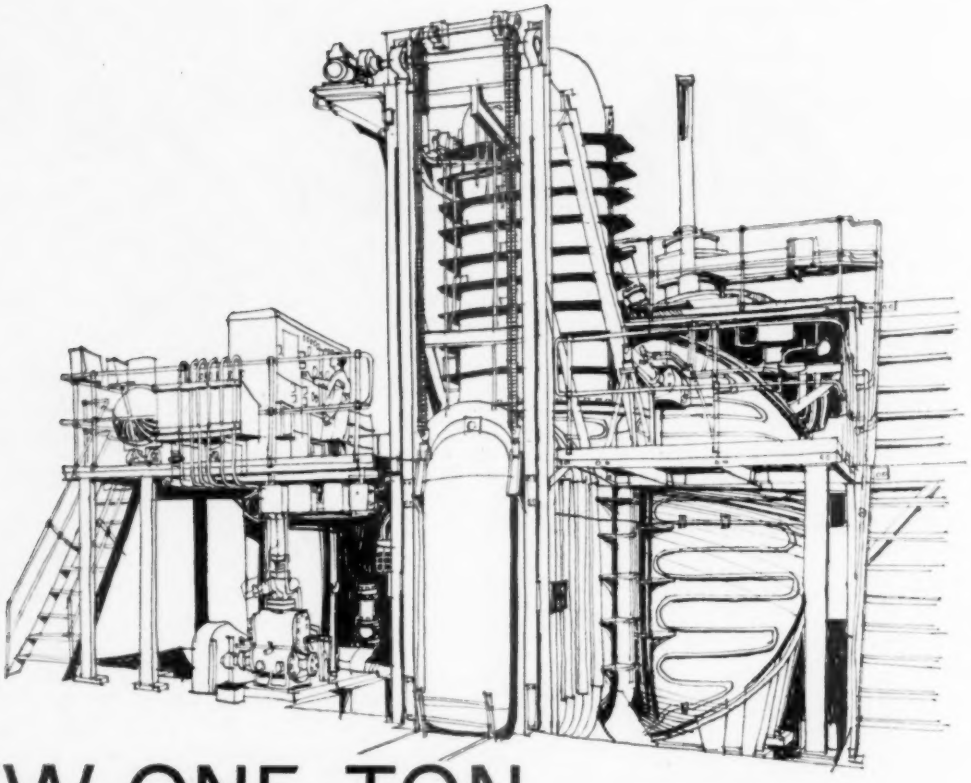

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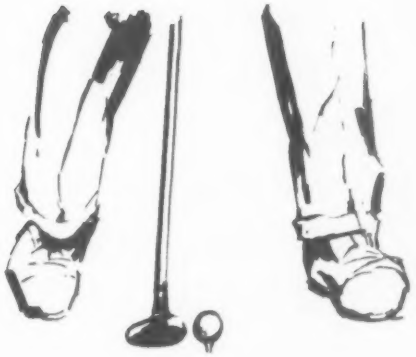

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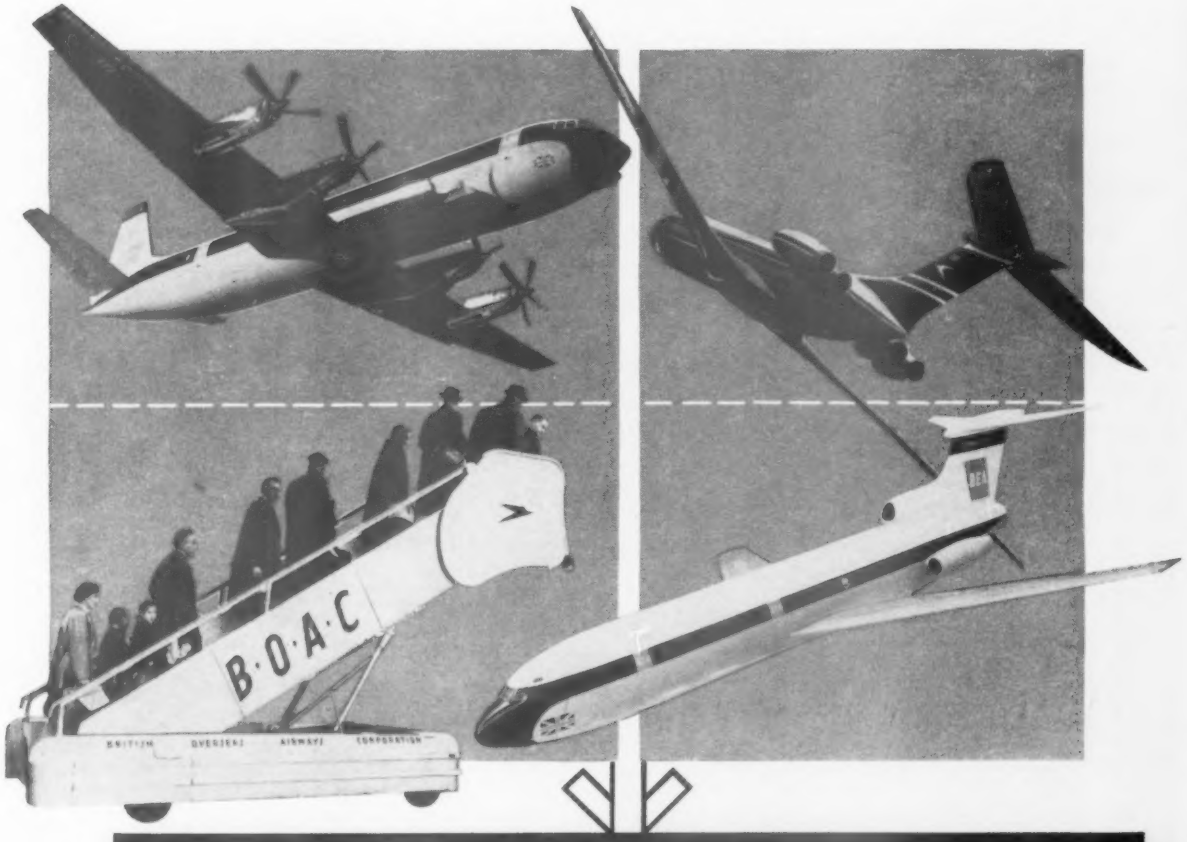

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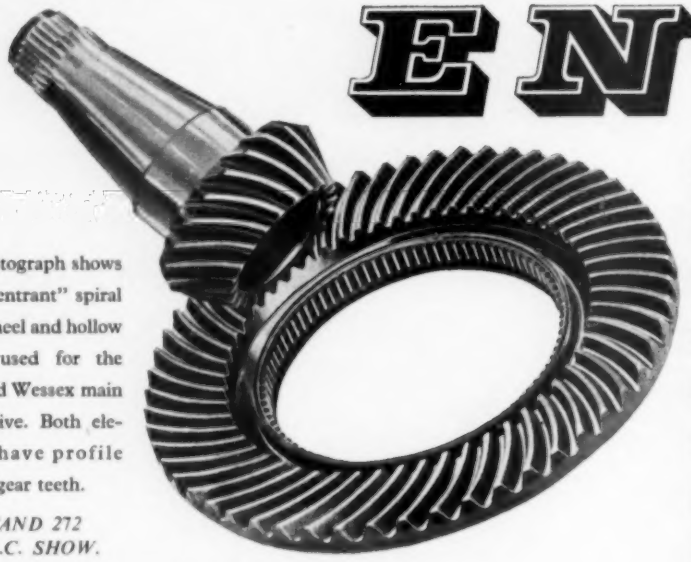

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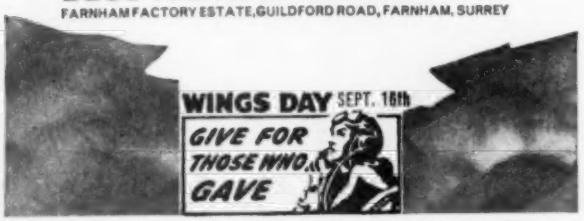

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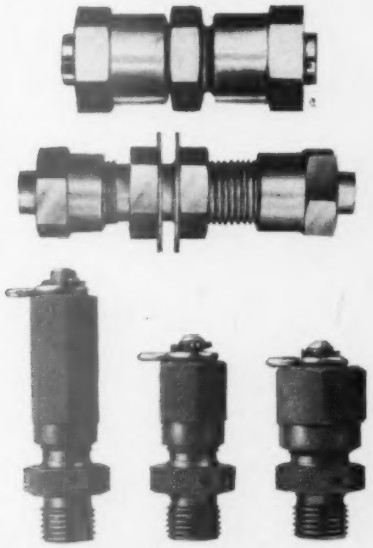

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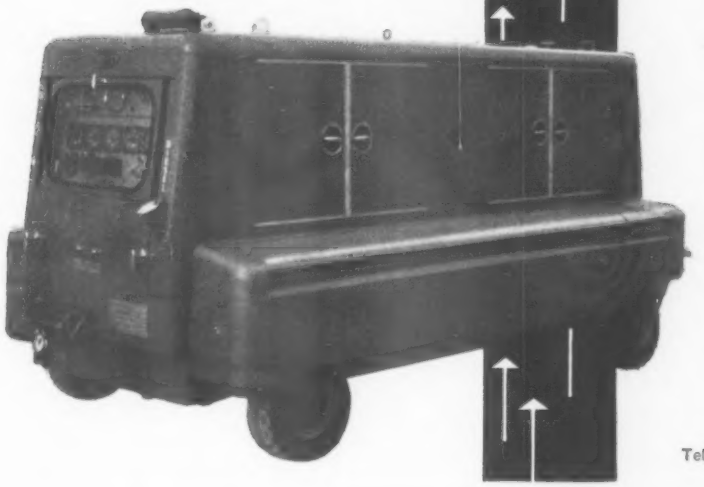

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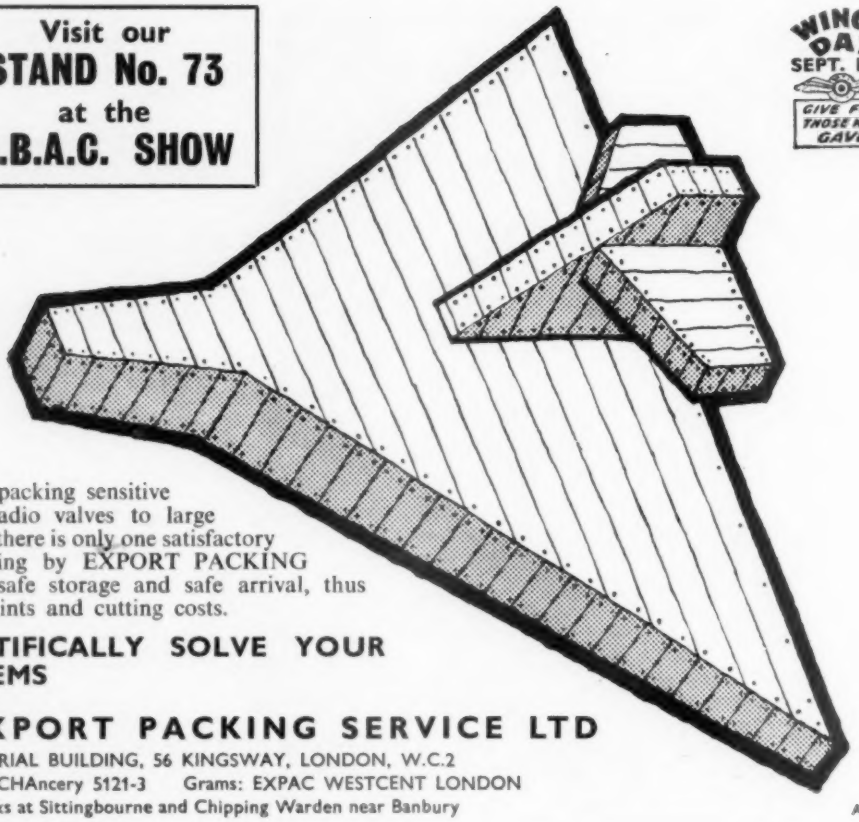

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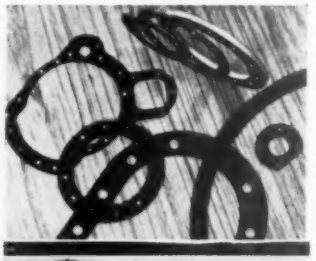

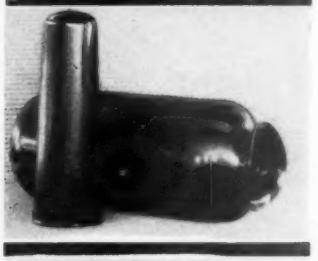

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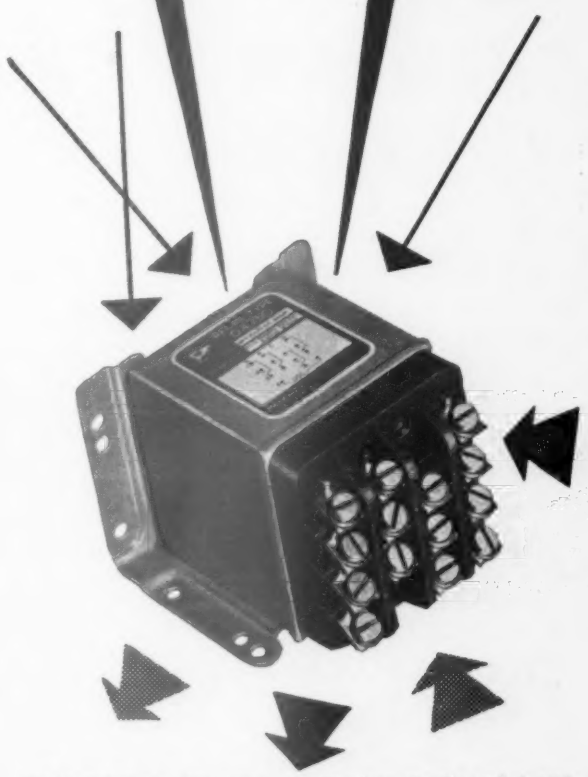

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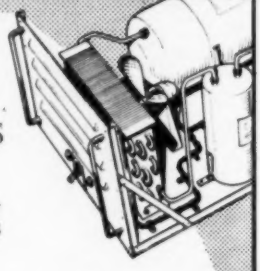

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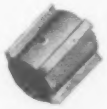

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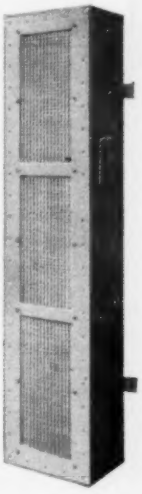

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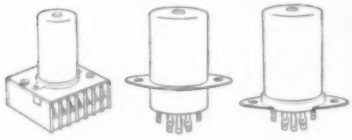

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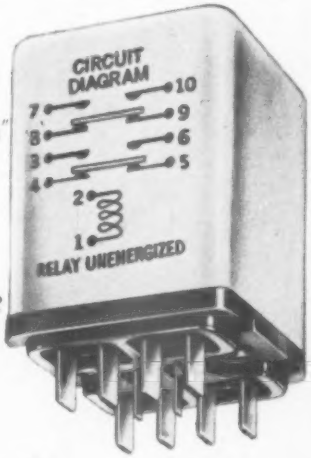

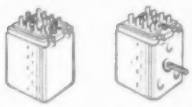

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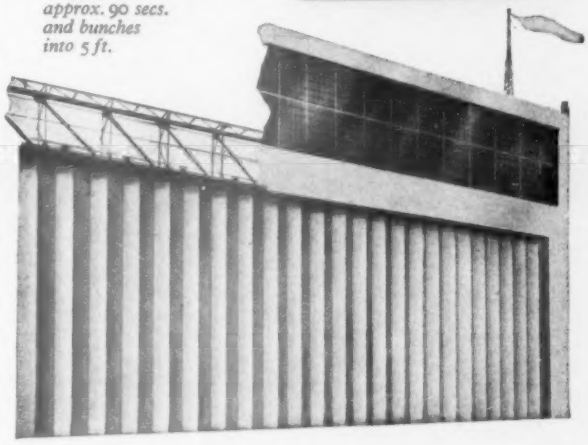

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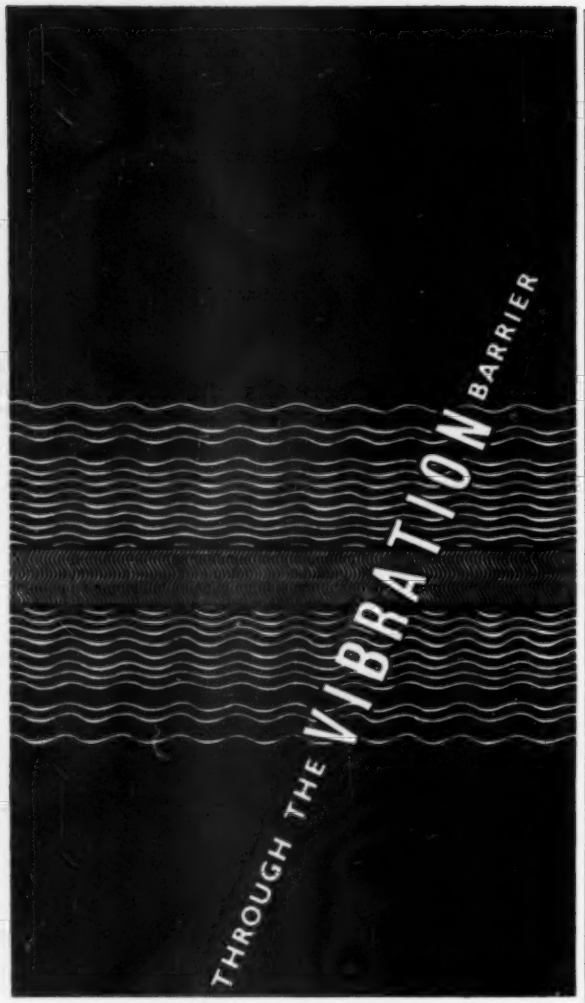

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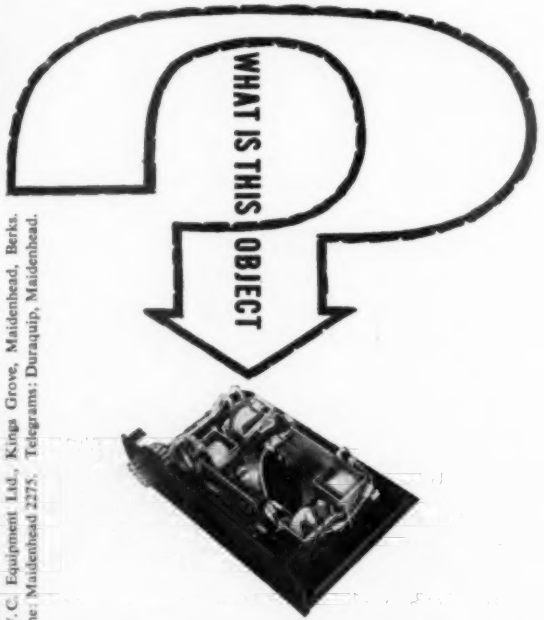

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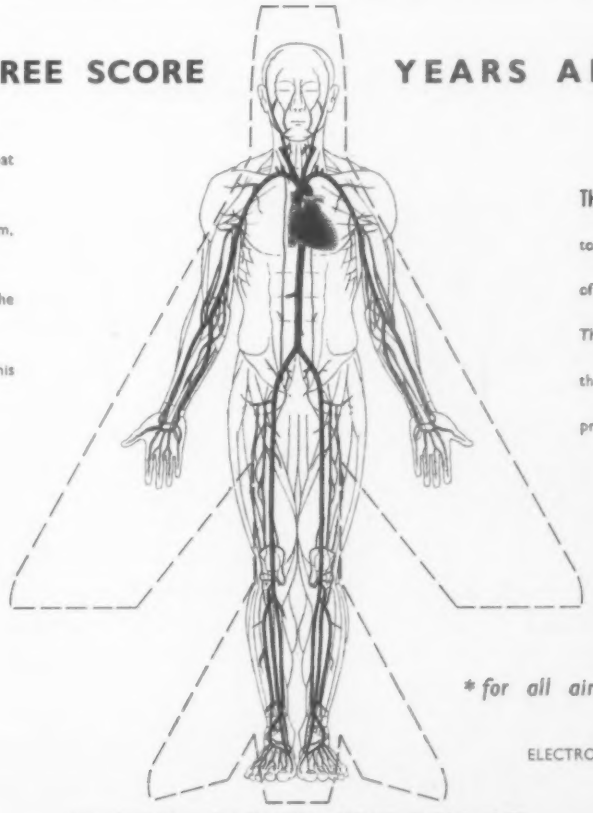

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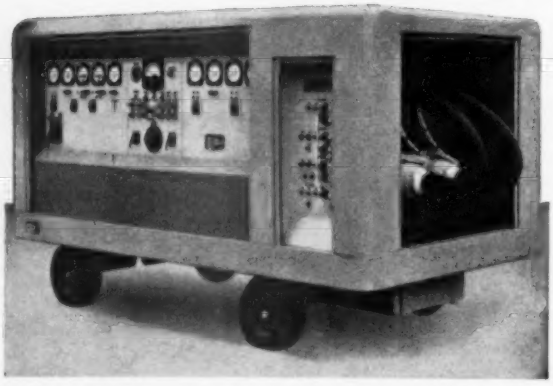

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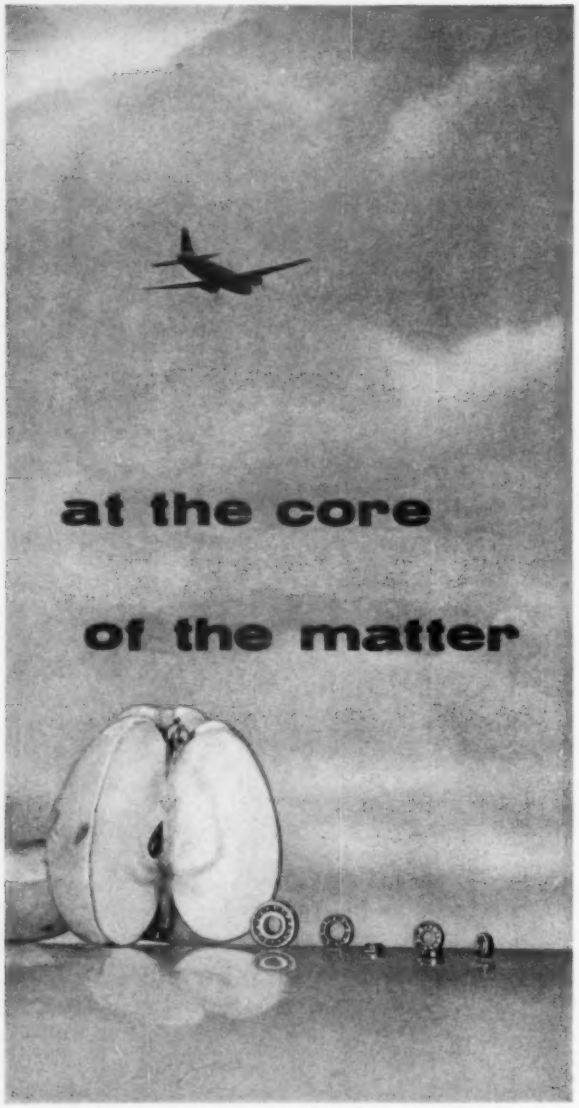

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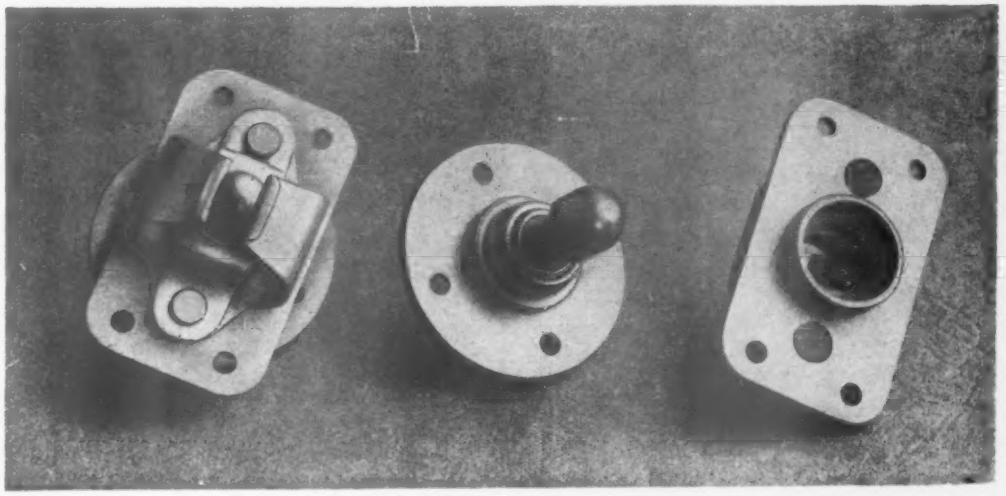

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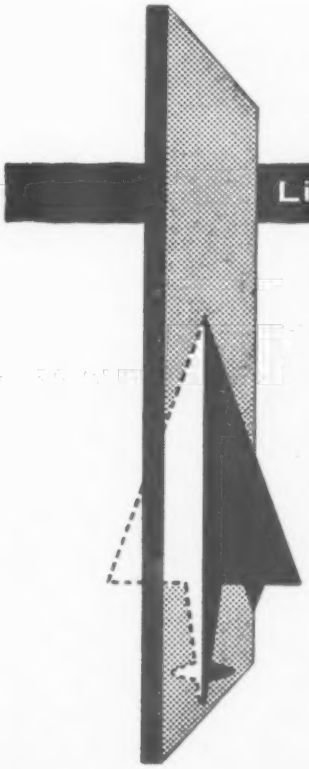

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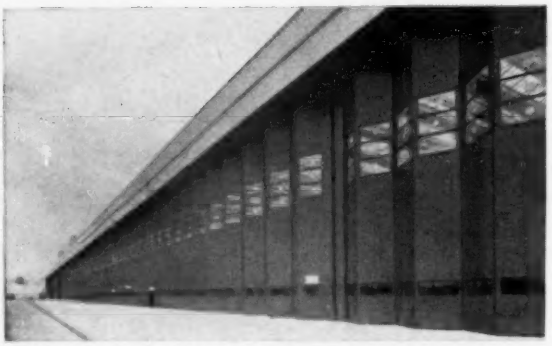

Esavian folding doors at the B.E.A. Vanguard Engineering Base, London Airport.

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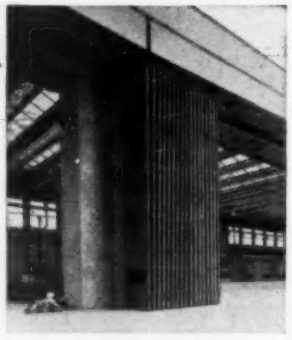

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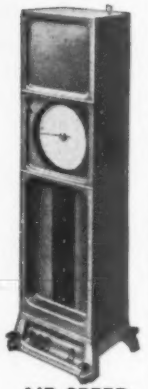

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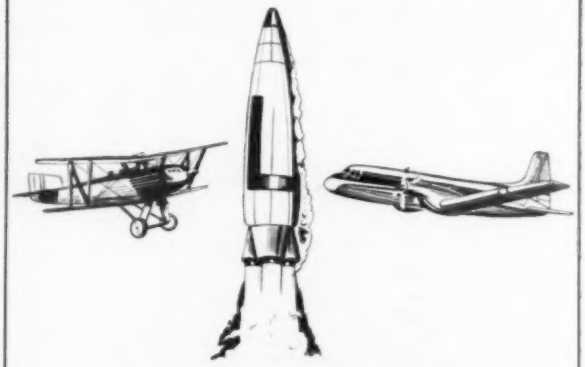

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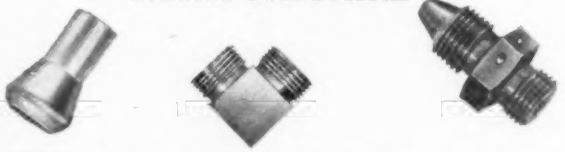

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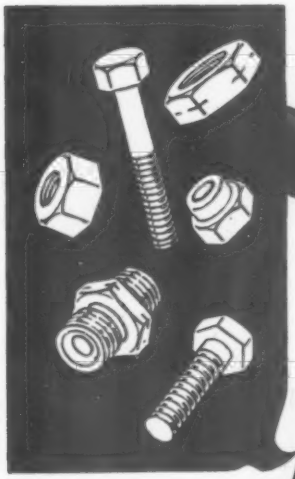

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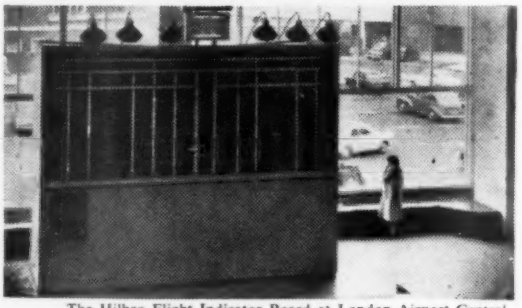

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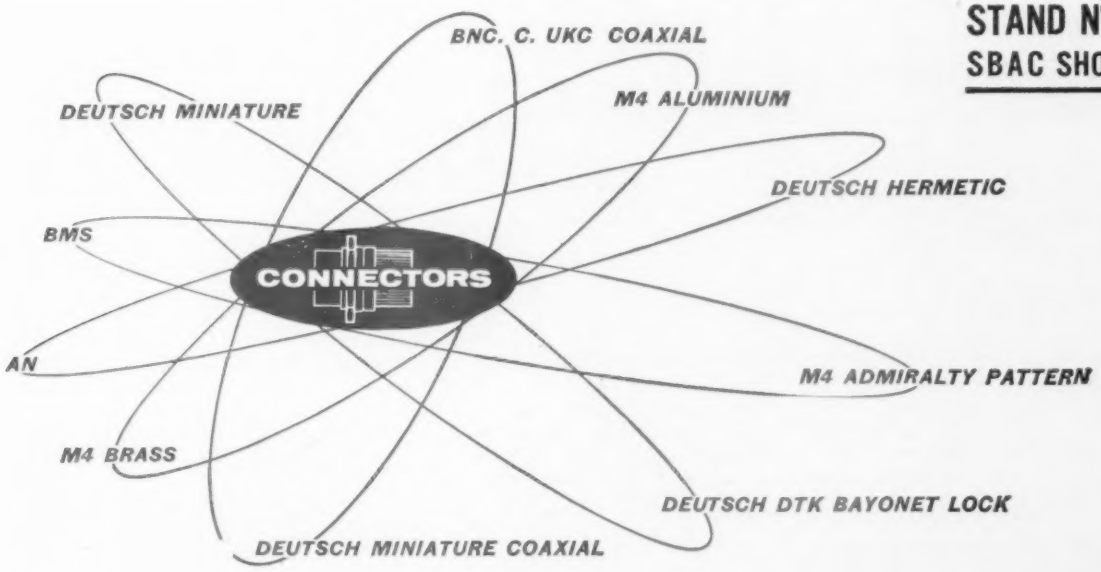

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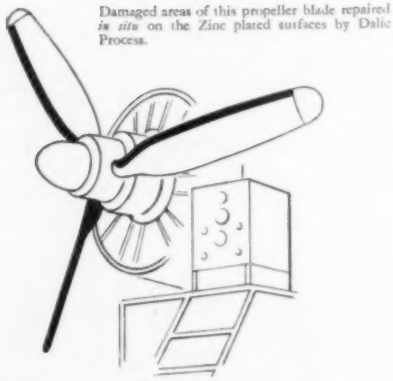

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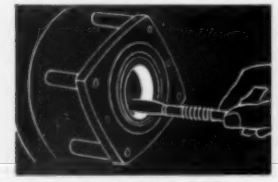

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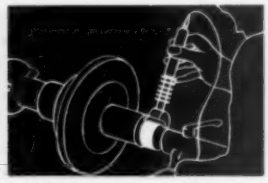

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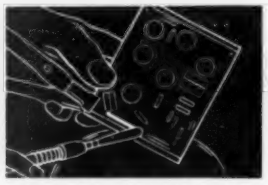

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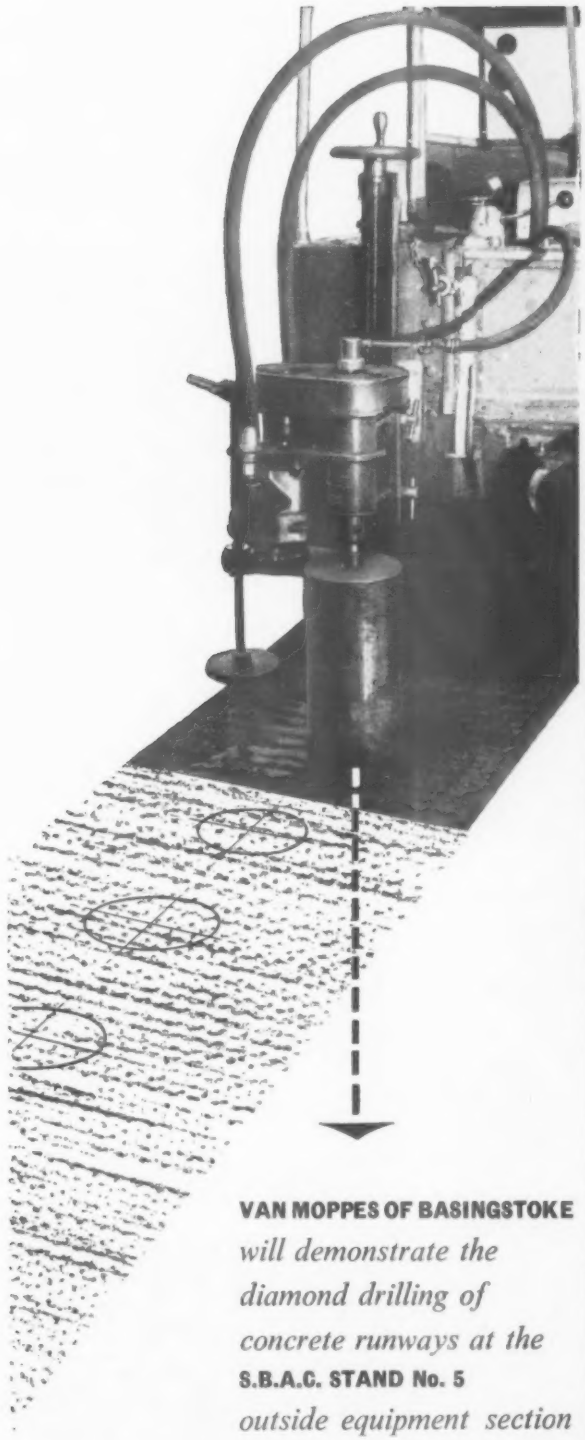

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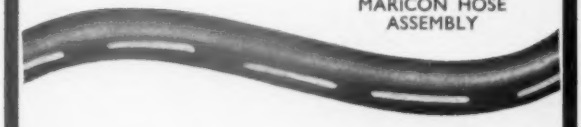

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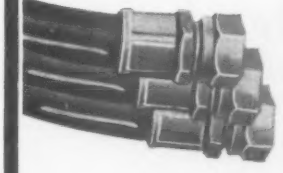

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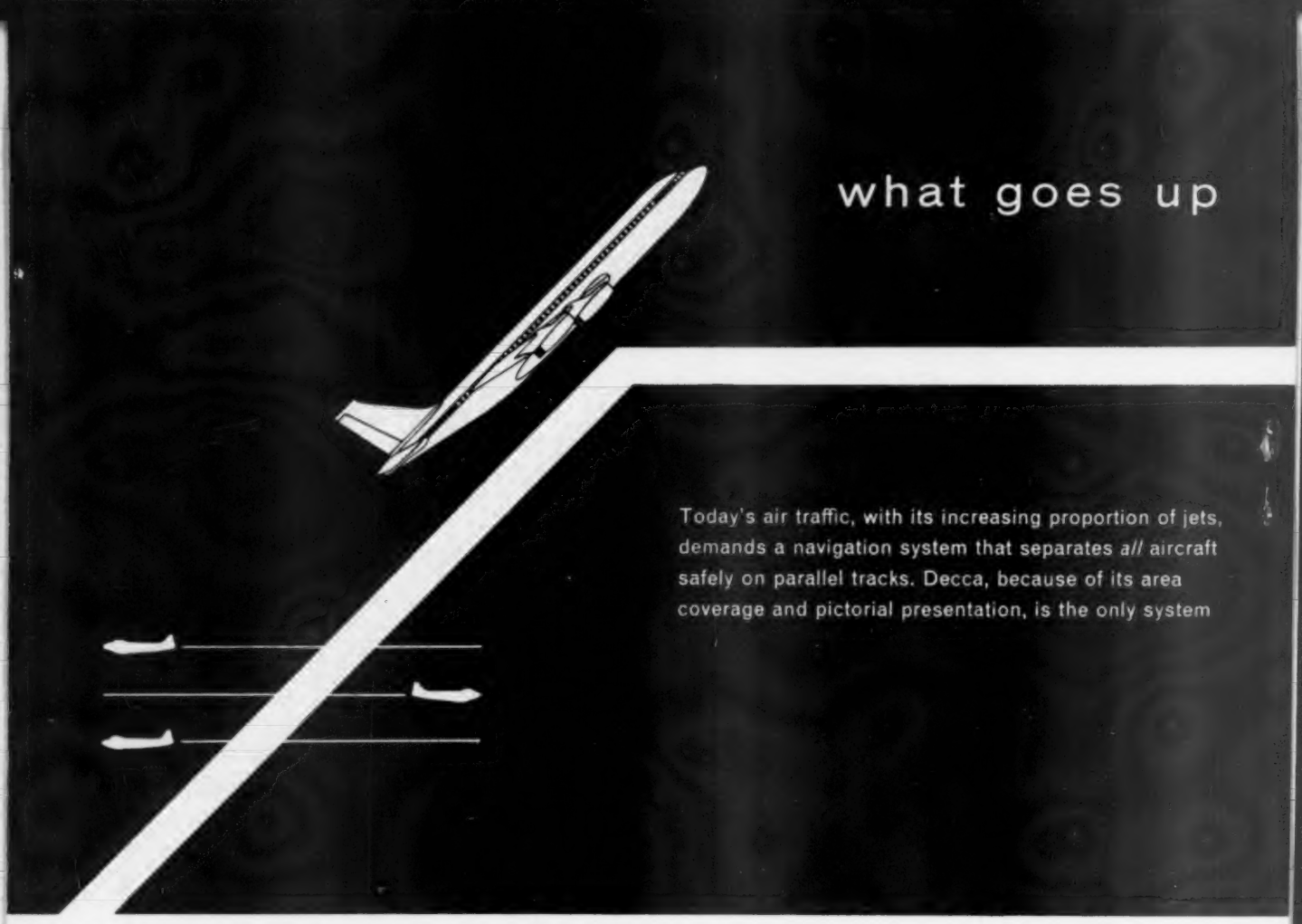
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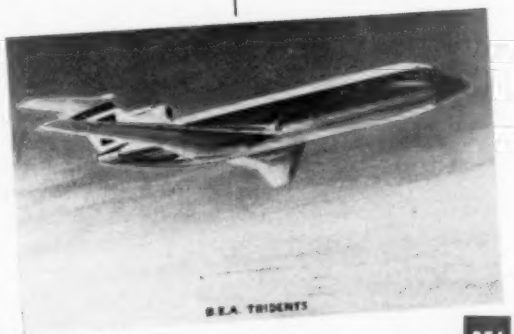

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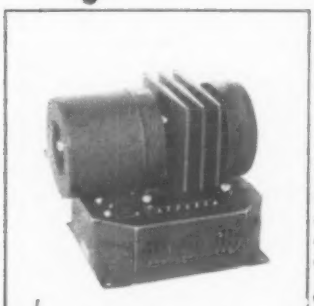

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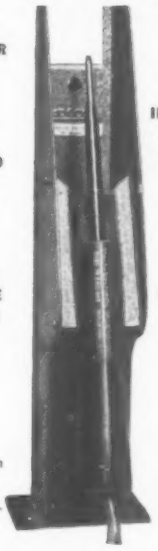

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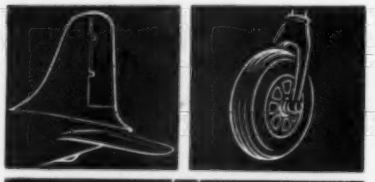

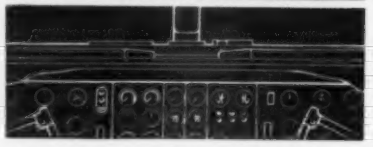

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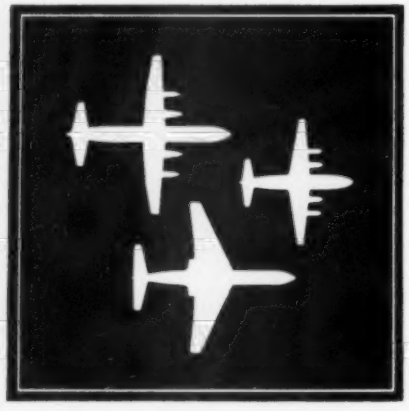

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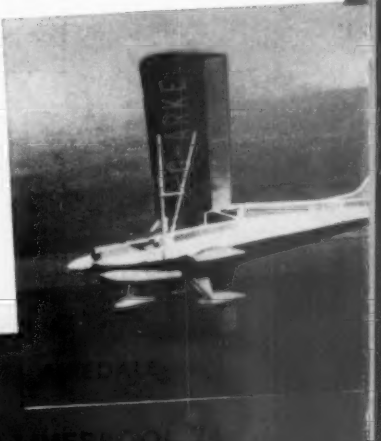

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